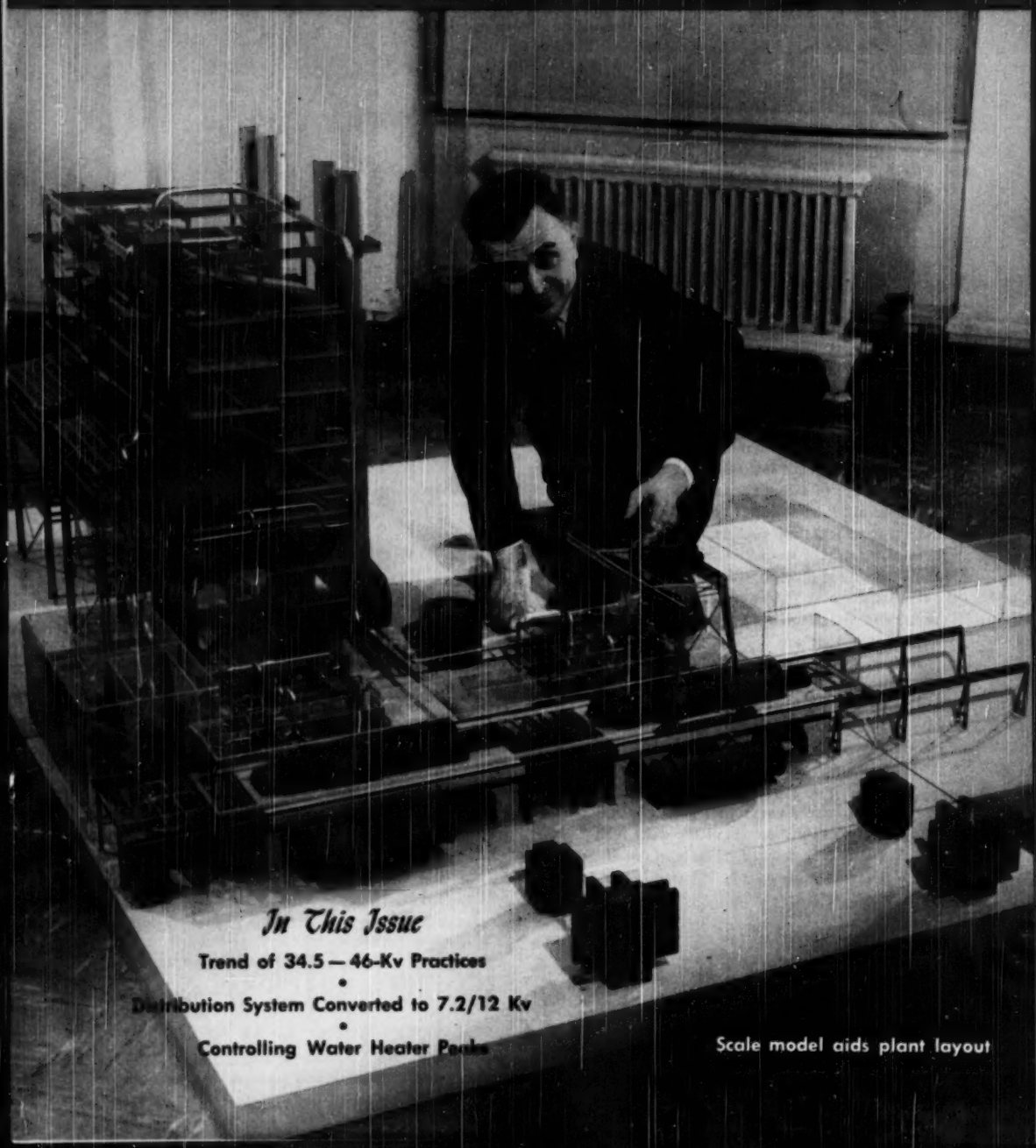
ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION



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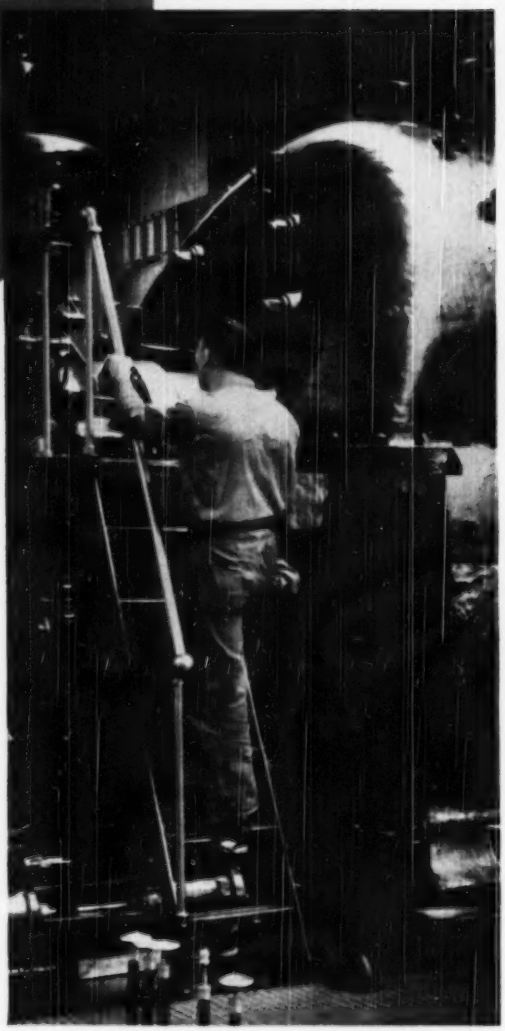
LIFELONG PROTECTION

Against Foam, Sludge, Rust

Use TEXACO REGAL OILS (R&O)



Throughout their long service life, *Texaco Regal Oils (R & O)* protect against foam, sludge and rust . . . assure an extra margin of safety for turbines.

The special processing that keeps *Texaco Regal Oils (R & O)* from foaming, plus an effective oxidation inhibitor, assures freedom from sludge . . . clear oil lines and uninterrupted protection for bearings. In addition, the rust inhibitor in *Texaco Regal Oils (R & O)* keeps the system free of rust. Governor action is always smooth and instantly responsive.

Manufacturers of turbines—both steam and hydro—recommend the use of inhibited turbine oils. *Texaco Regal Oils (R & O)* meet the exacting requirements of all leading turbine builders, and the turbine oil specifications of the U. S. Navy.

A Texaco Lubrication Engineer will gladly help you select the *Texaco Regal Oils (R & O)* that will give improved performance under your particular operating conditions. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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FOR ALL TURBINES

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ELECTRICAL WORLD

Published for 76 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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SOLVE IT WITH

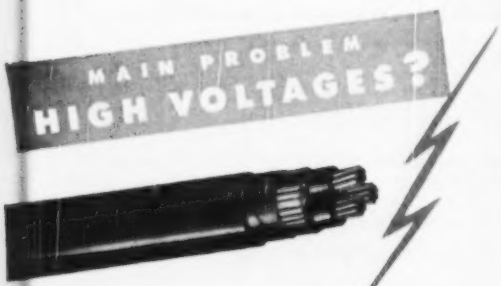
HAZARD WATERTITE!

Hazard Watertite offers you a long-lived insulation with high dielectric strength that's effectively impervious to moisture. It's tough, elastic and free stripping. In wet locations, Hazard Watertite speeds and simplifies installation as no protective lead sheath with costly, time-consuming joints and terminals is needed. Since its earliest development as Submarine insulation for non-metallic sheathed underground cables, Watertite has a history of over 20 years in trouble-free service. Approved under NEC as Type RW for use in wet locations without metallic sheath, or Type RH for use at a maximum conductor temperature of 75C.

YOUR ANSWER IS

HAZARD PERFORMITE!

Specially developed to withstand the deteriorating effects of heat on insulation, Hazard Performite gives you an ideal answer to this difficult installation problem. Since 1931, this Hazard insulation has been used extensively for all kinds of general interior circuits, branch feeders, portable cables, municipal cables and other special installations demanding *long, trouble-free service life and exceptional heat resistance*. Performite is long-aging, non-corrosive, free-stripping, mechanically and electrically stable. Approved under NEC as Type RH for use at a maximum conductor temperature of 75C.



BE SAFE WITH

HAZARD KEYSTONE!

Hazard Keystone, field-proved over the past 50 years, is an oil-base insulation for high-voltage installation. *It combines in one compound* – resistance to ozone, corona, moisture, heat, sunlight, mildew, acids and chemicals. Your assurance of long, trouble-free service from aerial, underground or interior cable installations with Hazard Keystone insulation is backed by its long, successful service record as well as thorough factory testing which includes both a-c and d-c tests for service over 5000 volts.

There's a Preferred Hazard Insulation for Every Job

For full information about Hazard Watertite insulation write for Bulletin H-422; H-403A gives all the facts about Keystone and H-431 about Performite or ask your Hazard representative. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

ANCHORAGE for the NEUTRAL SUPPORTED SYSTEM OF SERVICE DROPS . . .

PAT. PEND.

Electroline Automatic Dead End

The 3800 Series Service-Drop Automatic Dead End, for holding pre-assembled service cable that uses a bare neutral conductor as the messenger. This service-drop dead end is assembled as a one-piece unit, with no loose parts to be dropped or lost. It has one end of the flexible bail detachable for installation around a spool type insulator or other supporting anchorage—permitting quick and easy installation. Only one part, other than the conductor, is handled by the lineman. This Electroline Automatic Service-Drop Dead End can be reclaimed and used again. But, once it is installed, it cannot become detached until conductor is removed by the lineman. The practice of gripping the bare neutral employed by the Electroline method of dead ending eliminates the danger of destroying the insulation and short circuiting phase wires.

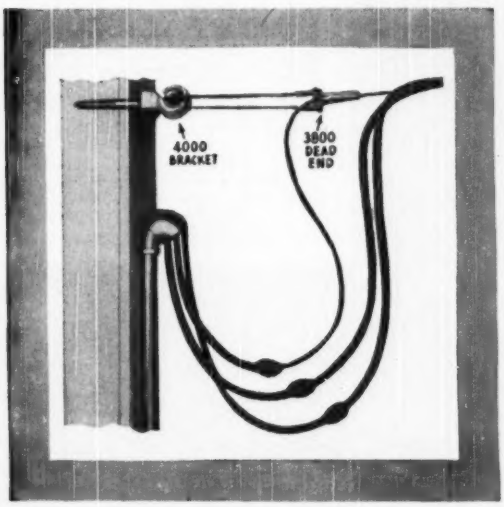
Electroline Anchor Bracket

The 4000 Series Service-Drop Anchor Bracket securely supports the cable at any angle. It is so designed that a closed bail or loop can be easily inserted without opening the loop. This one-piece, light weight unit reduces installation costs and no previous experience is necessary to install it.

The 4000 Bracket eliminates the insulator and insulator hardware at the building.

Two types are available: one with a ½" diameter galvanized lag screw in lengths from 3" to 5" inclusive. The other type contains a ½-13 galvanized nut for use in installations where a threaded end of bolt extends through wall of building.

The Electroline 4000 Series Anchor Bracket is made of aluminum and a galvanized steel lag screw, or nut to withstand corrosion and the discoloration of outside building walls . . . it is vibration-proof and fool-proof.



Both the Electroline Service-Drop Automatic Dead End and Anchor Bracket are designed to harmonize with residential and commercial buildings.

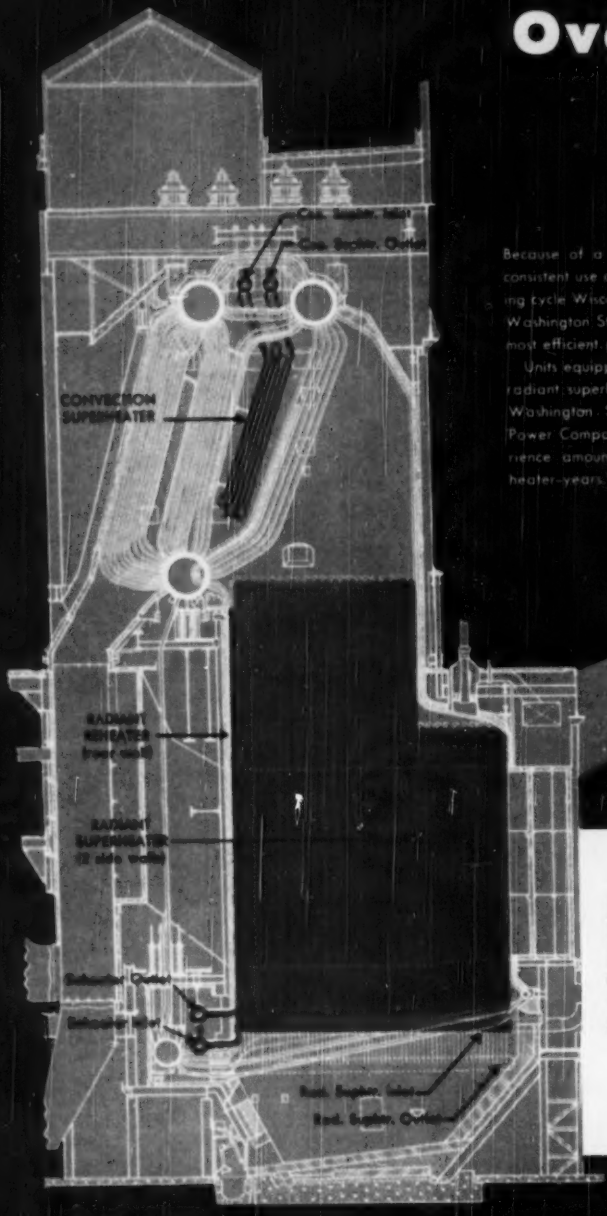
Write for new bulletins for complete details.

Electroline Company

4121 South La Salle Street Chicago 9, Illinois

IN CANADA
POWERLITE DEVICES, LTD., TORONTO

Over 500

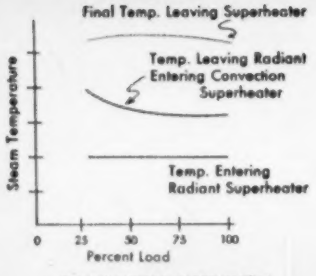


Because of a farsighted program involving the consistent use of a high temperature resuperheating cycle Wisconsin Electric Power Company's Port Washington Station is today one of the country's most efficient power plants.

Units equipped with FW radiant reheaters and radiant superheaters at both Lakeside and Port Washington Stations of the Wisconsin Electric Power Company show a total of successful experience amounting to over 500 "radiant superheater-years."

1949

FOSTER



COMBINATION SUPERHEATER

Fig. 1
Note flat final steam temperature

FOSTER WHEELER CORPORATION

"radiant superheater-years"

in one utility alone*

*See TRANSACTIONS of the ASME, August 1949, page 738

1929 1935 1943 1948

WHEELER RADIANT REHEATERS and SUPERHEATERS

Foster Wheeler experience in the design and operation of radiant and convection surface dates from 1902 with the introduction of commercial use of superheated steam into the United States. ***A wider selection of fuels*** for resuperheating units may be obtained by using superheaters and reheaters which include F-W radiant heat absorbing sections. This is in sharp contrast to the all convection type which will provide a wide range of steam temperature control at the risk of considerable slagging in both furnace and hotter convection zones. This also applies in the case of non-reheat units with wide control ranges. Performance data on units equipped with F-W radiant surfaces for superheating and resuperheating at the Lakeside and Port Washington Stations of the Wisconsin Electric Power Company also testify to such advantages as ***a very high operating reliability*** and ***the compensating effect in temperature characteristics*** as against exclusively convection arrangements with steep load temperature curves (see figures 1 and 2). The fact that 35.6% of the total BTU duty on Unit No. 5 at Port Washington will be performed by the superheater and reheater well illustrates the magnitude of this function of a modern steam generator.

Availability at Port Washington is 95%. To date, four units incorporating F-W radiant reheating and radiant and convection superheaters have been installed in the Port Washington Station. The fourth unit was started in August 1949 and a fifth is in fabrication. The combined availability of the first three operating units, the initial one of which was installed in 1936, is 95% for a total of 147,235 hours of service as of December 26th, 1948.

For further information, write for Paper No. 48-A-120

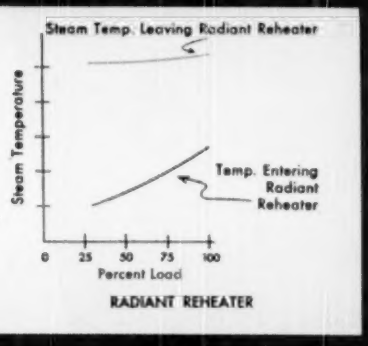


Fig. 2
characteristics over wide load ranges

165 BROADWAY, NEW YORK 6, N. Y.

FOSTER WHEELER

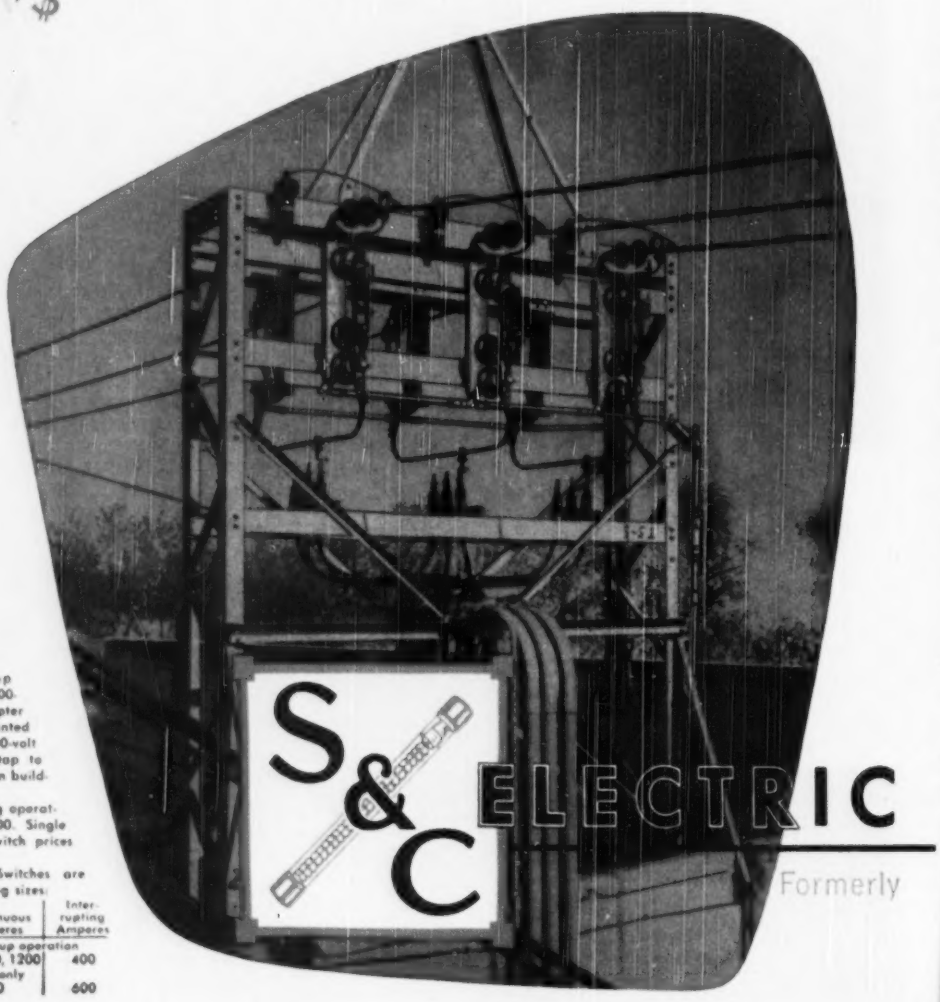
HAVE YOU SWITCHING

① Where Horn Gap Switches Are Inadequate

because they cannot, under all conditions, safely break magnetizing or charging currents; nor can they interrupt load currents

② Where Circuit Breakers Are Becoming Too Expensive

for non-automatic switching and short circuit protection



Two three-pole, group operated, 7,500-volt, 400-ampere, Alduti Interrupter Switches vertically mounted back to back, in 2,300-volt overhead loop circuit tap to load center substation in building below.

Price each, including operating mechanism, $490.00. Single pole stick operated switch prices as low as $65.00.

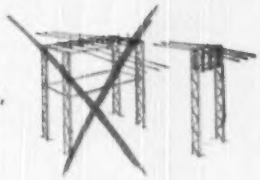
Alduti Interrupter Switches are supplied in the following sizes:

Volts	Continuous Amperes	Interrupting Amperes
For hook stick or group operation		
7500 & 15000	400, 600, 1200	400
For group operation only		
23000 & 34500	600	600

APPLICATIONS . . . . .

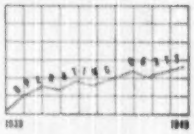
③ Where Structure Design Is Restricted

because horn gap switches can be mounted only in the horizontal upright position, need wide phase spacings, and always require an operating mechanism



④ Where Switching Sequences Are Too Complicated And Costly

because multiple operations—involving breakers, disconnects, and operating personnel—are required to isolate equipment or sectionalize circuits



ALDUTI INTERRUPTER SWITCHES

offer a proved and economical solution to such application problems.

Ten years of actual operating experience in thousands of installations, and many field trials under inordinately severe test conditions, have demonstrated convincingly the ability of these Interrupters to—safely and repeatedly—

Sectionalize either radial or loop distribution and subtransmission circuits, under either load or charging current conditions . . .

Switch load and magnetizing currents of transformer banks . . .

Switch charging currents of capacitor banks.

Because there is NO EXTERNAL ARCING during the operation of Alduti Interrupters: they need not be mounted only horizontally upright, but can also be mounted vertically, or horizontally underhung; hook stick operation can be employed where economy dictates; and phase spacings can be reduced to 18 inches for the 7,500-volt and 39 inches for the 34,500-volt switches. Hence structures can be smaller, connections simpler, and construction cost can be reduced below that of installing horn gap switches. Also, Alduti Interrupters can be installed in cubicles, thus providing—even for subtransmission applications—enclosed "packaged-type" switches, thereby permitting the complete enclosure of all components of a unit-type substation.

When combined with S & C Power Fuses, Alduti Fused Interrupters also provide short circuit protection with fault current interrupting ability up to 40,000 amperes asymmetrical, thus making possible the elimination of expensive circuit breakers where automatic switching is not required.

OPERATING, CONSTRUCTION, AND MOUNTING DETAILS, INTERRUPTING RATINGS, AND FIELD TEST REPORTS WILL BE MAILED ON REQUEST

S & C ELECTRIC COMPANY

SCHWEITZER & CONRAD, INC.

S & C ELECTRIC COMPANY
4421 Ravenswood Avenue
Chicago 40, Illinois

☐ Please send complete information on .....7.5 kv, ... 15 kv, ... 23 kv, ...34.5 kv Alduti Interrupter Switches

☐ Have representative call

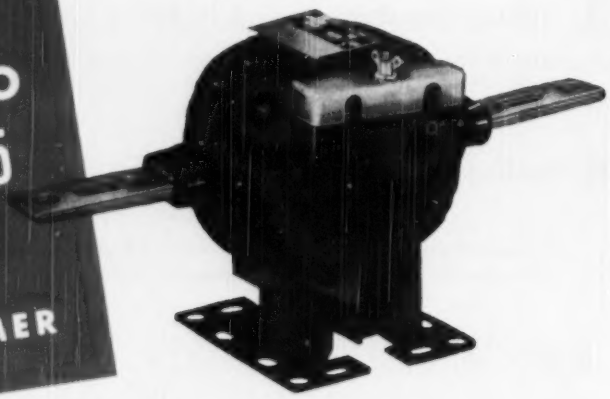
Name ..... Title .....

Company .....

Street & Number .....

City ..... Zone ..... State .....

NEW!
SANGAMO Type MA-25
INDOOR CURRENT TRANSFORMER



Small Transformer-High Impulse Level
for 2400-volt Delta Circuits

Here's a small, inexpensive, completely dependable transformer for your medium voltage metering applications.

The new Sangamo Type MA-25 current transformer provides the high accuracy, high insulation levels, and thermal and mechanical characteristics specified by American Standards Association for dependable service on 2400-volt delta circuits.

This transformer has the same uniform base mounting dimension as the standards for the 600-volt transformer generally used on low voltage circuits. All capacities—from 10 through 800 amperes are physically interchangeable.

Bulletin 501 gives complete information on Sangamo Current Transformers.

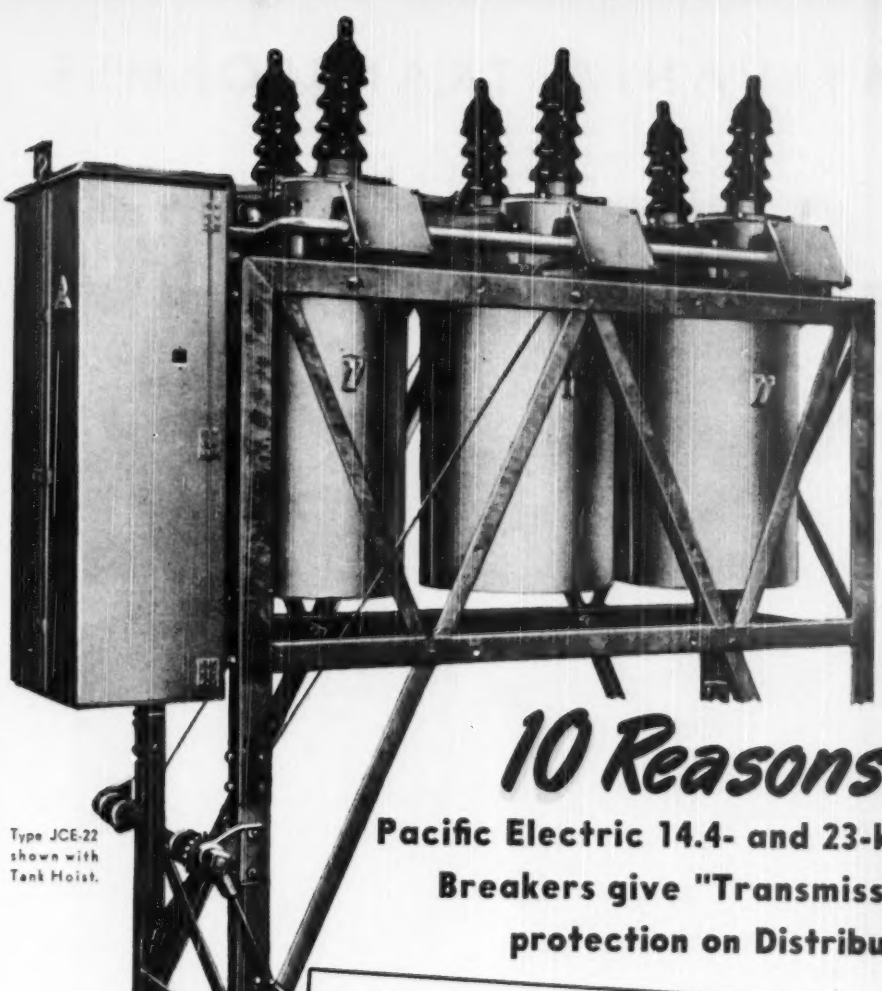
SPECIFICATIONS . . .

Accuracy:
Classification 0.3 for burdens B-0.1, B-0.2 and B-0.5.

Insulation:
2.5 KV class test requirements—15 KV at 60 cycles and 45 KV full wave impulse level.

Thermal and Mechanical Ratings:
Continuous thermal current rating factor, 1.0. One-second thermal limit, 70 times rated current. Mechanical short-time limit, 85 times rated current.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



New Protective Performance for

- Feeders
- Distribution Lines
- Industrial Loads

Type JCE-22 shown with Tank Hoist.

10 Reasons Why

Pacific Electric 14.4- and 23-kv Circuit Breakers give "Transmission-type" protection on Distribution Lines

TYPE JCE
Oil Circuit Breakers

14.4 kv — 600 amp
100,000 int. kva;
600 and 1200 amp
250,000 int. kva;
23 kv — 600 amp
250,000 int. kva.

NEMA STANDARDS

1. **Motor-Compressed Closing Springs** — assure positive reclosing from **full-open** position. If control power lost, manual recompression takes but one-half to one minute; normal closing then follows.
2. **Always Full-Energy Closing**—closing power not dependent on system or control voltage—no slow opening or blow-back from sustained fault.
3. **Single-Unit Rotary Contact Structure**—moves as one piece—under no mechanical stress in either open or closed position—easy to inspect.
4. **Simple Interrupter**—a glance shows whether or not it is "in order."
5. **Sliding-Shoe Nested Contacts**—easy to inspect—separate surfaces for arcing and load currents—leaf springs apply nearly constant pressure so require no adjustment during contact life—wiping action insures clean contact—no sensitive adjustment required to fix closed position—no mechanical stress on bushings at any time.
6. **Trip Free** — mechanically and electrically, in any position.
7. **Control Current No Greater Than Trip Current** —even for high speed reclosing, the control current is carried by small-sized wires.
8. **3-Shot Reclosing Timer** — mounted in operating-mechanism cabinet—for all usual duties including cut-off of instantaneous attachment after first reclose, if specified.
9. **Full A-c if Desired**—rectifiers not required—a-c control and series trip available with or without relays.
10. **Shipped Assembled**—tested and adjusted at the factory.

Get All Facts . .

Call

PACIFIC ELECTRIC MFG. CORPORATION

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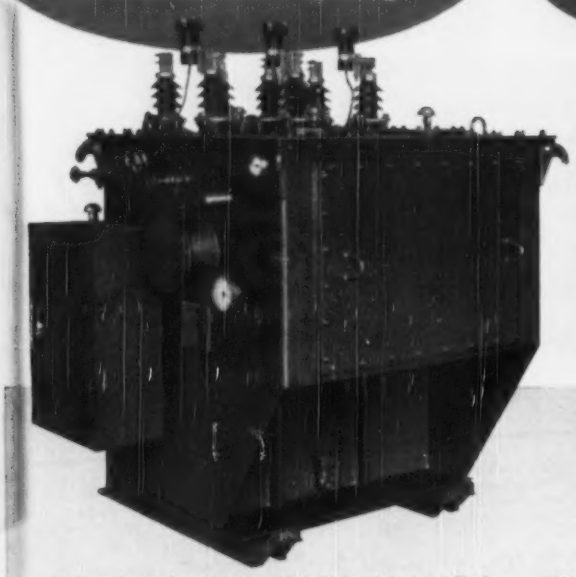
PENNSYLVANIA TRANSFORMER

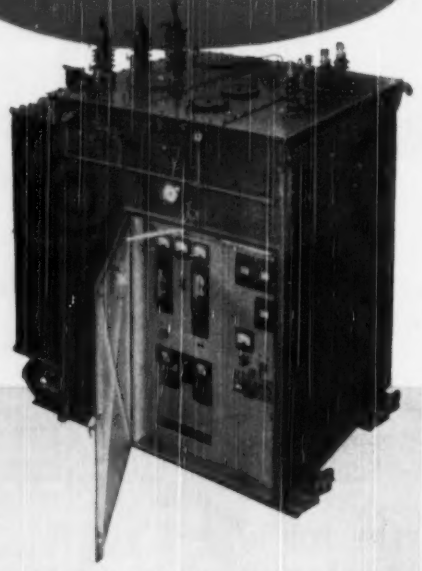
LOAD RATIO

for STEP VOLTAGE REGULATORS

for UNIT SUBSTATIONS



156 Kva Step Voltage Regulator. 12000 Volts. 32-⅝% taps. Total tap range plus or minus 10%.



1500 Kva Single Circuit Unit Substation. High Voltage:-22000 Volts. Low Voltage:-4160 Volts. 32-⅝% taps on Low Voltage winding.

Since 1937 Pennsylvania Transformer Company has been building Load Ratio Control Equipment for customers who desired the design and construction advantages of Pennsylvania Transformers.

About 5 years ago, Pennsylvania Engineers began developing Step Voltage Regulators as well as Single Circuit and Duplex Unit Substations.

For the past few years, Pennsylvania Transformer Company has been taking orders for, and has been building in ever increasing numbers, Load Ratio Control Transformers, Step Voltage Regulators and Unit Substations.

Recently Pennsylvania completed a new, modern Machine Shop designed specifically for manufacturing Load Ratio Control Equipment.

Now Pennsylvania is completely equipped and tooled to build Load Ratio Control Units on a regular production basis.

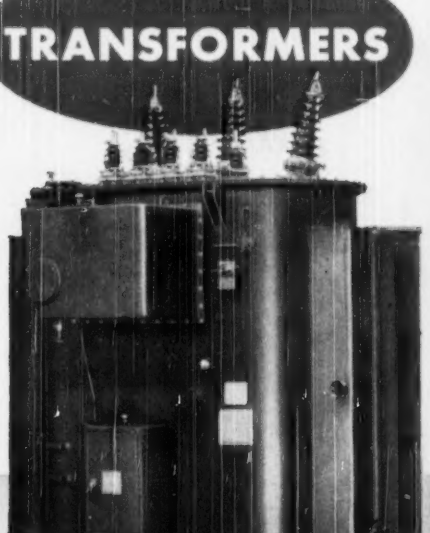
COMPANY

Announces

CONTROL

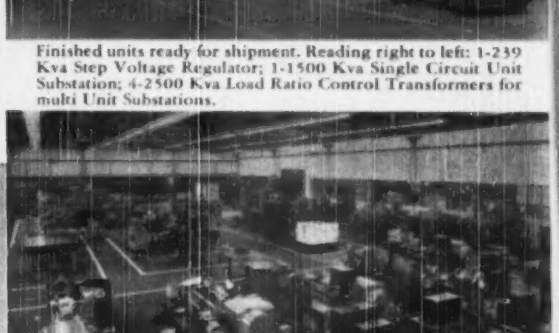
for

TRANSFORMERS



2500 Kva, 3 Phase, 66000-2500/4330Y x 7500/12990Y Volts. Low Voltage winding equipped with 16-15/16% taps for automatic tap changing under load.

Finished units ready for shipment. Reading right to left: 1-239 Kva Step Voltage Regulator; 1-1500 Kva Single Circuit Unit Substation; 4-2500 Kva Load Ratio Control Transformers for multi Unit Substations.



Pennsylvania's modern Machine Shop completely equipped with the latest machine tools for manufacturing Load Ratio Control equipment.

This is Pennsylvania's formal announcement to America's Utilities and Industrials that Pennsylvania Transformer Company is now regularly quoting on all types of Load Ratio Control equipment and Step Voltage Regulators.

Further information can be obtained by contacting a Pennsylvania Representative or by writing directly to Pennsylvania Transformer Company, P. O. Box 330, Canonsburg, Pa.

Pennsylvania

Pennsylvania TRANSFORMERS

TRANSFORMER COMPANY

CANONSBURG • PENNA.

Greater Pittsburgh District

PROVED AND APPROVED PROTECTION
KEYSTONE EXPULSION ARRESTER

NO LINE LOCKOUTS

Series gap enclosed; unaffected by sleet, snow or weather.

NO LEAKAGE CURRENT

. . . can flow through fibre arc-quenching element; this eliminates possibility of burning or charring fibre parts.

HIGH SURGE CURRENT CARRYING CAPACITY

Withstands surge current far in excess of NEMA—standard 65,000 amp discharge test.

PARALLEL DISCHARGE PATHS ASSURE LONG LIFE

Less follow current per path; reduces fibre erosion to minimum; which assures longer useful life.

LOW ARC RESISTANCE

. . . prevents complete chopping of voltage wave impressed across transformer insulation. Prolongs insulation life.

New features of construction . . . new technical advances proved in service . . . backed by 57 years of specialized experience in the field of lightning protection—all this adds up to the best there is in expulsion arresters!

The new Keystone expulsion type arrester provides low impulse sparkover and excellent transformer protection . . . high surge current carrying capacity . . . and its many new features assure long life of arresters and transformers.

This is just one of the many new developments by ESM. More are on their way! New technical and instructional data will soon be available on the basic fundamentals of purchasing and applying lightning arresters. Write today . . . let us put you on the list to receive this series of informative booklets. Yours for the asking . . . no obligation.

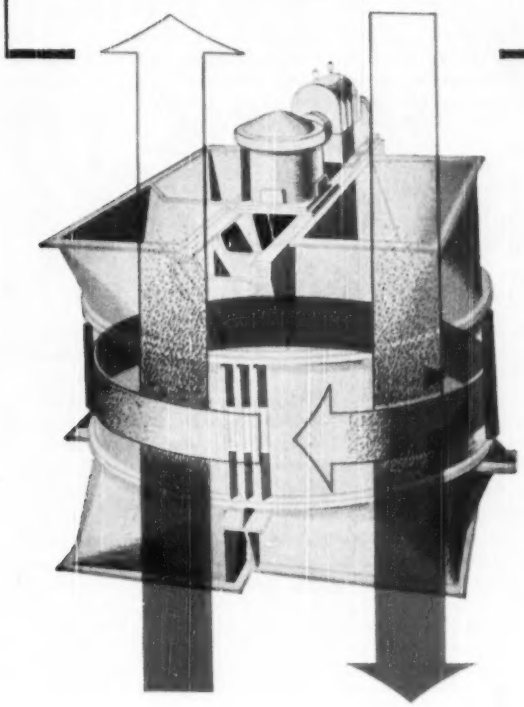
ELECTRIC SERVICE MANUFACTURING CO.

1709 CAMBRIA STREET PHILADELPHIA 32, PENNA.

more than 160,000,000 lbs/hr of post-war steam generating capacity

equipped with *Ljungstrom*

AIR PREHEATERS



Here indeed is impressive evidence of the wide acceptance of the Ljungstrom air preheater. Since the war the total capacity of steam generating units equipped with Ljungstrom air preheaters, installed, under construction or on order in industrial and utility plants throughout the country comes to well over 160,000,000 lbs of steam per hr.

The reasons for the steadily increasing preference for the Ljungstrom air preheater are simple enough. The continuous regenerative counterflow principle assures maximum heat transfer with minimum weight and size. Flexible and compact, it may be used in a wide range of applications. Its proven reliability and low maintenance eliminate costly shutdowns.

If you are planning to build a new plant or modernize an old one, investigate the possibilities of the Ljungstrom. The specialized experience of Air Preheater engineers is at your disposal, to aid in effecting the most economic heat recovery from flue gases.

The Ljungstrom operates on the continuous regenerative counterflow principle. The heat transfer surfaces in the rotor act as heat accumulators. As the rotor revolves the heat is transferred from the waste gases to the incoming cold air.

THE AIR PREHEATER CORPORATION

60 EAST 42d STREET • NEW YORK 17, NEW YORK

again A Westinghouse

GOES INTO ACTION

ANOTHER EXCITING LIGHT-BULB CONTEST FOR YOUR POWER-USER CUSTOMERS

Who is Miss Wink?

CONTEST

Millions of Americans will begin seeing this picture of one of the country's most popular celebrities when Westinghouse launches its huge advertising program April 15. Contestants buy 3 bulbs and complete a jingle. Writers of best 477 jingles automatically win prizes and get chance to name Miss Wink for bonus prizes. Official Westinghouse records show that in the recent Westinghouse contest, many dealers who tied in and promoted the event gained sales increases up to 100%. And that means *increased load!* That's why it will pay you to build a spring lamp selling promotion around this new contest.

HOW TO TIE IN

Yes, here's a contest that's a "natural" to promote with dealers. And the *Special Spring Bag Promotion*, designed especially for electric service companies, represents a popular and timely tie-in. (See opposite page)

YOU CAN BE SURE... IF IT'S

Promotional Powerhouse

WITH 3 BIG SPRING EVENTS

2 IT'S IN THE BAG!

This Handsome, Full-Color Container
Holds Any Assortment of Popular Size Bulbs

Here's one of the most unusual promotion ideas we've ever offered . . . "Light Up For Spring" light bulb bag. Printed in attractive colors, it's an ideal way for you and your dealers to sell more light bulbs during the Spring housecleaning season.

Dealers will welcome these bright, colorful containers as well as the equally colorful display cards, streamers, etc. that go with it. Ask your nearest Westinghouse District Office for a copy of "Profit that Blooms in the Spring"... or write to the Lamp Division, Westinghouse Electric Corporation, Bloomfield, New Jersey.

3 AND ANOTHER CASH CONTEST FOR DEALERS

Number 3, in the Westinghouse trio of Spring promotions is a display contest for dealers who participate in tying in with the "Miss Wink" contest.

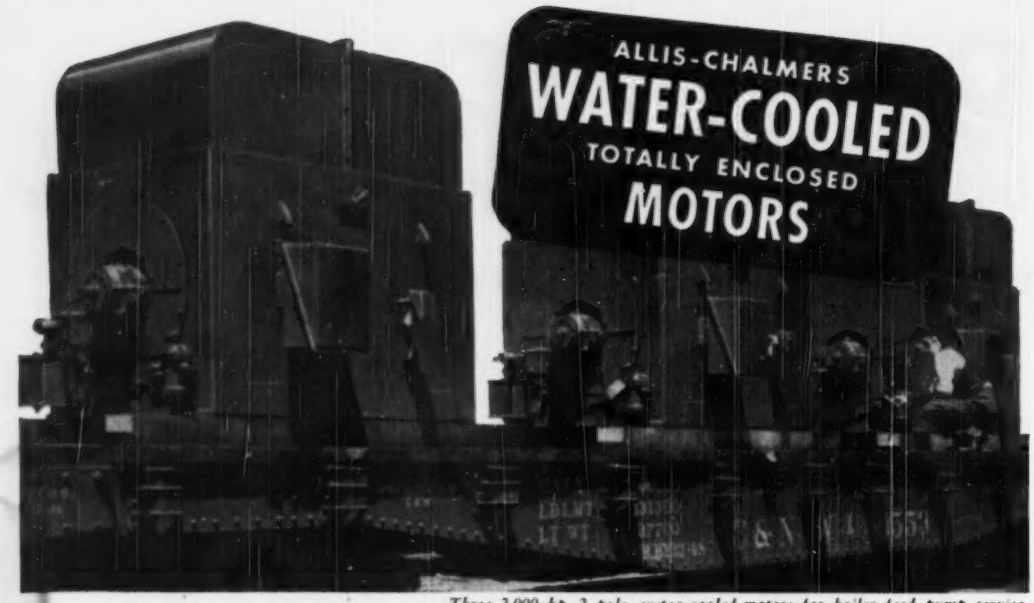
There's $5,000 in the jackpot, enough, we believe, to again win all-out cooperation from retailers. Here, then, is another brass-tacks reason why it will pay electric service companies to build their Spring promotions around this unusual Westinghouse project.

The Dealer Contest is open to all Westinghouse lamp dealers and their employees. A photograph of the "Miss Wink" contest display, plus a 100-word statement, constitutes an entry. You and your dealers profit no matter who wins the Westinghouse prizes.

$3,500 CASH
133 PRIZES
FOR BEST CONSUMER CONTEST TIE-IN

In Previous Contests Many Dealers Reported SALES UPPED 100%

Westinghouse



Three 2,000-hp, 2 pole, water-cooled motors for boiler feed pump service.

DIRT-PROOF

COOLER Dissipate motor heat in water. Keep heat out of power-house.

QUIETER Lower sound level where unusually quiet motors are required.

AND Protect against dirt, corrosion and moisture. Permit outdoor installations.

YOU CAN PRACTICALLY ELIMINATE maintenance due to dust, dirt, fly ash, and moisture by using Allis-Chalmers water-cooled, totally enclosed construction for power plant auxiliary motors.

Place these protected motors outdoors or indoors, and you'll enjoy positive dirt protection. Indoors there'll be less heat in the power-house — especially in the summer time.

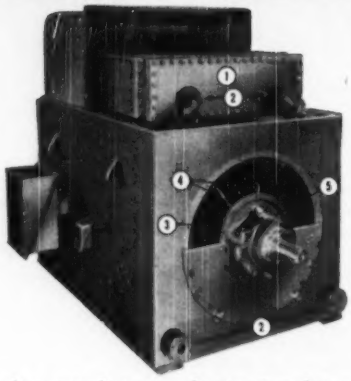
In addition, you'll find that this A-C ventilating and cooling system lowers the sound level.

Motors of this type can be provided for the larger power-house auxiliary drives. Size and weight are not appreciably increased over open motors of the same rating.

For complete information, outline your requirements to your nearby A-C Sales Office, or write direct. A-2973

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

WATER-COOLED MOTOR CONSTRUCTION



1. Air-to-water heat exchanger
2. Water connections
3. Rotor fan
4. Air pressure lines to bearing oil guard to prevent oil leakage into windings
5. Capsule type bearing

ALLIS-CHALMERS

ANHYDREX INSULATION + NEOPRENE JACKET = 5-POINT PROTECTION for UNDERGROUND NETWORK CABLES

Anhydrex insulation. Neoprene jacket. Here's a combination that's hard to beat for all-around protection against the hazards that menace underground network cables.

It's exclusive in Simplex-ANHYDREX Cables, and it is their assurance to you of the always-reliable performance that network service demands. More than that, the Anhydrex-Neoprene team keeps down weight and diameter, provides excellent flexibility, does away with the need for duct lubricants, and facilitates jointing, tapping, and terminating, all of which add up to low-cost installation and maintenance.

Check the advantages listed here. See if they don't point to the trouble-free operation you're looking for. And if you would like more-complete information, including specification data, about ANHYDREX Underground Cables, just fill in and return the coupon below.

1. **Moisture Resistance**

   Rigid laboratory testing proves that Anhydrex insulation will not absorb harmful quantities of water. Throughout many years of service in underground and submarine installations no ANHYDREX Cable has ever failed due to water absorption.

2. **Resistance to the Acids, Alkalies, and Corrosive Chemicals Prevalent in Underground Ducts**

3. **Protection Against Oil, Heat and Flame**

   The neoprene jacket will not support combustion and it effectively resists deterioration by oil and heat.

4. **Elimination of Crystallization and Corrosion**

   Needing no outer metallic coverings, ANHYDREX Cables are not subject to electrolysis nor harmed by vibration, stray or secondary currents.

5. **Resistance to Abrasion and Rough Handling**

   The neoprene jacket is unexcelled for toughness; will withstand even more abuse than the best natural rubber compounds.

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 Sidney St., Cambridge 39, Mass.

SIMPLEX WIRE & CABLE CO.
79 SIDNEY ST., CAMBRIDGE 39, MASS.
GENTLEMEN: PLEASE SEND A COPY OF CATALOG 1013 TO:

NAME _____ TITLE _____
COMPANY _____
STREET _____
CITY _____ STATE _____

Satisfactory results are assured with

A few of the outstanding features which assure satisfactory performance from Riley Traveling Grate Spreader Stokers . . .

1 Feeder Drive

The completely enclosed splash lubricated Riley feeder drive assures long trouble free operation and provides complete speed control from zero feed to maximum.

2 Overthrowing Distributor

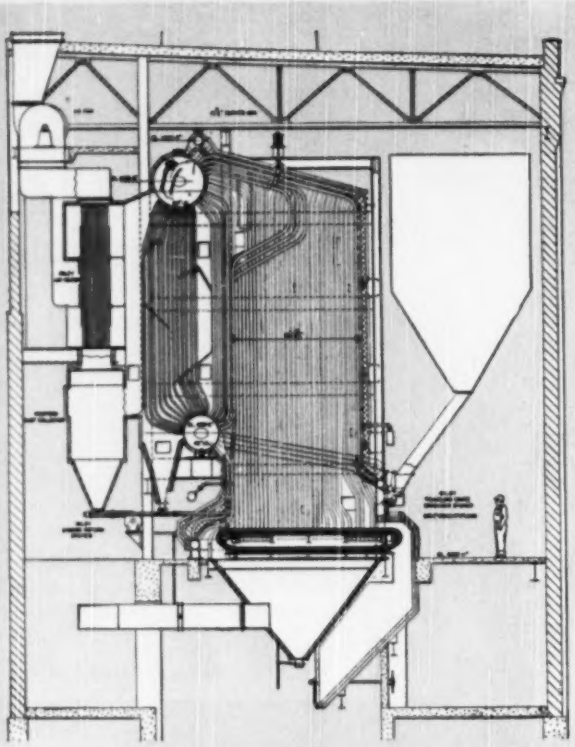
The Riley overthrowing distributor with adjustable blades provides uniform lateral and longitudinal distribution. Ready access to distributor is provided from front of stoker.

3 Hydraulic Grate Drive

Riley uses a hydraulically driven ratchet drive completely enclosed and automatically lubricated which is not susceptible to damage in case of grate obstruction and which requires but little power to drive.

4 Efficient Grate Surface

The Riley grate surface consists of grates 2" wide by 6" pitch assuring uniform air distribution and low maintenance. The grate clips are mounted on carrier bars which in turn are fastened to roller conveyor chains giving a true traveling grate surface.



Central Illinois Light Co., Springfield, Ill.
125,000 lbs./hr. Riley Steam Generating Unit
fired by 20' x 17' Riley Traveling Grate Spreader Stoker

These well-known companies have ordered Riley Traveling Grate Spreader Stokers

Ohio Edison Company
Iowa-Illinois Gas & Electric Co.
Central Illinois Light Co.
Otter Tail Power Co.
Cliffs Power & Light Co.
Carbide & Carbon Chemical Corp.
Celanese Corp. of America
Swift & Company
Utica Knitting Co.
Sangamo Electric Co.
General Time Instrument Co.
Stokely Foods, Inc.
Armstrong Cork Co.
Kaiser-Frazer Corp.
Minnkota Power Co-operative
General Fireproofing
City of Provo, Utah
City of Eugene, Oregon
City of Ames, Iowa
University of Minnesota

TRADE MARK Rx REGISTERED

RILEY

STOKER CORPORATION, WORCESTER, MASS.

Boston New York Philadelphia Washington Buffalo Pittsburgh Cleveland Detroit Chicago
Cincinnati Atlanta New Orleans Memphis St. Louis Kansas City St. Paul Tulsa Houston
Denver Salt Lake City Los Angeles Portland Seattle

BOILERS • PULVERIZERS • BURNERS • STOKERS • SUPERHEATERS • FLUE GAS SCRUBBERS

RILEY traveling grate spreader stokers

Riley Stoker Corporation has well over fifty years of stoker experience. Riley is also one of the oldest manufacturers of traveling grate stokers in the country. There is a world of stoker experience back of Riley Traveling Grate Spreader Stokers.

Furnace view of Riley Traveling Grate Stoker. Enlarged view shows travel of grate around rear of stoker.

Hydraulic Riley Grate Drive
Note absence of chains and speed reducers

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings [illegible] costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS • WATER-COOLED FURNACES • STEEL-CLAD [illegible] SETTINGS • AIR HEATERS

When you hang a

Wagner

rural-line Transformer

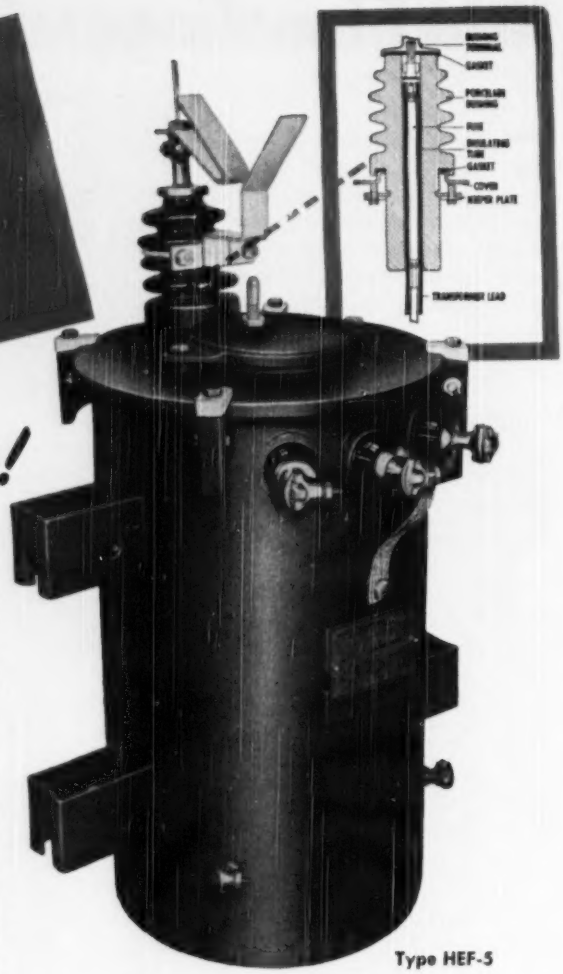
... it's up to stay!

Dependable, continuous service with a minimum of attention is a "must" for rural-line transformers. The loss of a single unit and the necessary labor to replace it is so great that reliable operation is a major factor to consider when buying transformers. Wagner Rural-Line Transformers are known for long troublefree performance . . . service records indicate that the failure rate of Wagner Transformers is substantially lower than that of the overall failure rate on systems where comparative checks are made. Such performance is a combination of fine engineering and fine shop practice . . . that's what you get in Wagner Transformers.

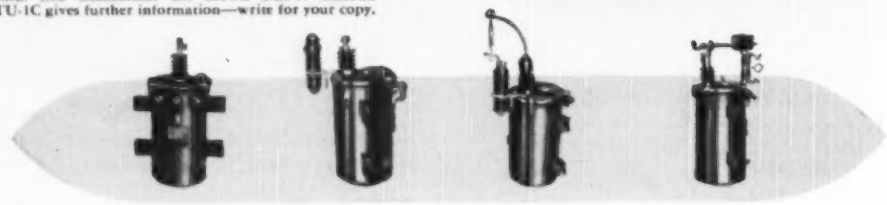
PERFORMANCE *Plus* PROTECTION

Wagner makes a complete line of rural transformers with protective devices to meet your particular needs. For example, type HEF-5, illustrated, features a double "bird-proof" gap to provide surge protection for the transformer, and an internal fuse in the high voltage bushing to form a protective link between the transformer and the high voltage line. When the double gap and internal fuse are combined no other surge protection or fuses are required. Type HEF-5 gives complete, low-cost protection.

Other Wagner protected types and a conventional type rural line transformer are shown below. Bulletin TU-1C gives further information—write for your copy.



Type HEF-5



Wagner's nationwide organization provides fast, convenient service, with 29 branches ready to help you with your transformer problem.

WAGNER ELECTRIC CORPORATION
6458 Plymouth Ave., St. Louis 14, Mo., U.S.A.

Wagner Electric Corporation
EST. 1891

ELECTRIC MOTORS - TRANSFORMERS - INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS - AIR AND HYDRAULIC

BRANCHES IN 29 PRINCIPAL CITIES

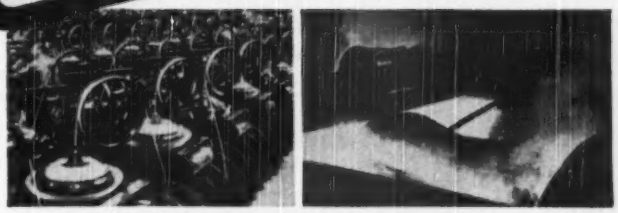
TM-4

Prove to your own satisfaction, as others have, that "Glazon" is the building wire for your jobs. Prove to yourself that it pulls easier . . . twists around bends more flexibly . . . handles better than any other building wire you've ever used!

Prove, too, that "Glazon" means longer life . . . better protection . . . greater resistance to exposure and deterioration. And prove to yourself what others have learned: that "Glazon's" easier handling and longer life—at no extra premium—all add up to today's greatest building wire value!

What "Glazon" Is:

"Glazon" incorporates a tougher, smoother, longer lasting braid based on continuous filament glass yarn—which cannot rot, burn, absorb moisture or deteriorate with age. Special saturants bond permanently to individual fibers, setting new standards of resistance to moisture, fire and rot. Result: smaller diameter, greater flexibility, smoother surface—in short, vastly improved fishability...combined with still longer life.



The Right Combination—"Glazon" protective coverings combine carefully controlled braiding, specially developed saturants—and manufacturing technique exclusive with Triangle. "Glazon" means building wire at its best!

The Trade Mark Of Top Value

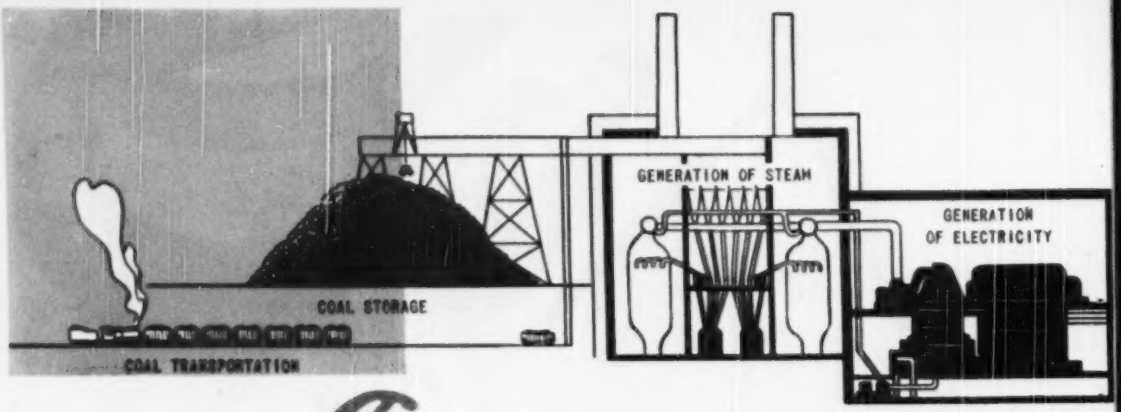
TRIANGLE CONDUIT & CABLE CO., INC.

1900 JERSEY AVENUE • NEW BRUNSWICK, NEW JERSEY

IT *MUST* BE RIGHT!

Catalog No. 500 Gives Full Details Of the Complete Triangle Line

"Glazon" & "Trieseal" Building Wire • "Tricon" Control Wire • "Adoptal" General Purpose Wire • "Triex" Non-Metallic Sheathed Cable • "Trisprene" Trench Cable • Service Entrance, Parkway, Power & Varnished Cambric Cables • "Tristeel" Flexible, Thin Wall & Rigid Steel Conduit

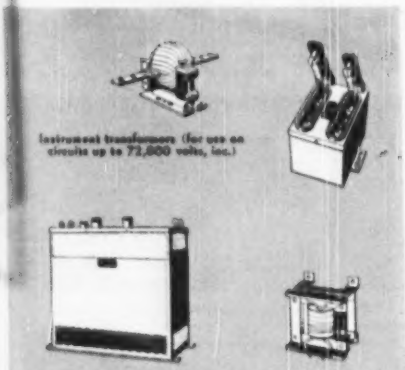


Standard

TRADE MARK ®

TRANSFORMERS

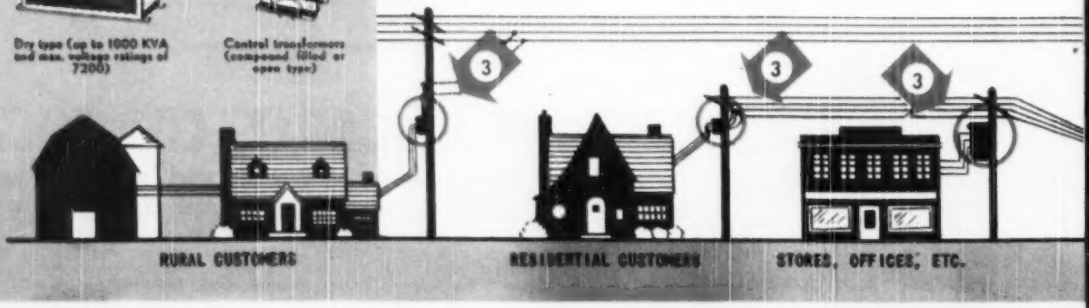
RELIABLE LINKS IN THE CHAIN OF DEPENDABLE ELECTRICAL SERVICE

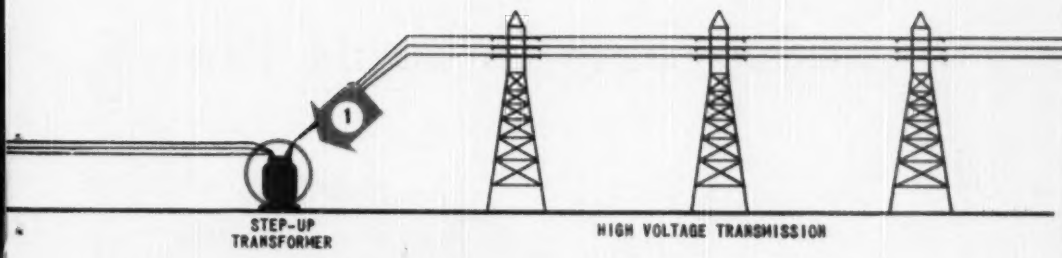

Instrument transformers (for use on circuits up to 72,500 volts, inc.)
Dry type (up to 1000 KVA and max. voltage ratings of 7200)
Control transformers (compound filled or open type)

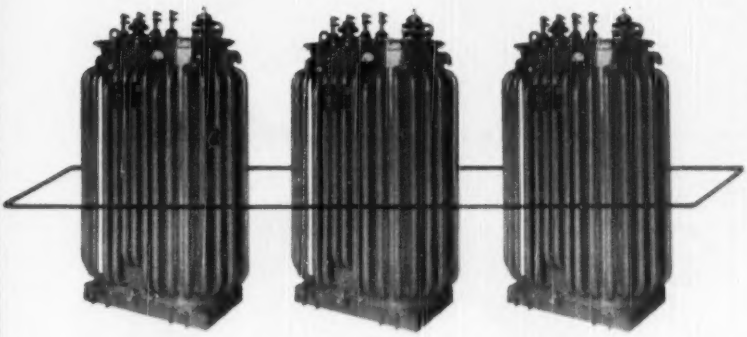
The Electrical Industry can depend on STANDARD to supply transformers for ANY APPLICATION in the production, transmission and distribution of electric power.

1 Power transformers, for your specific transmission requirements, whether special or standard, are available quickly, as STANDARD specializes in made-to-order transformers.

It takes no longer to get a specially designed transformer than it does a stock type.

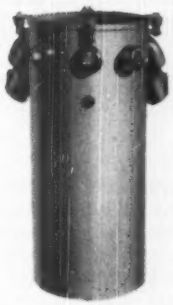






2 As in all of STANDARD transformers, substation types are designed to conform to industry standards. A complete range of sizes and types is built to the exact engineering specifications of the user. Space-saving and other economies are realized when you take advantage of STANDARD individualized engineering.

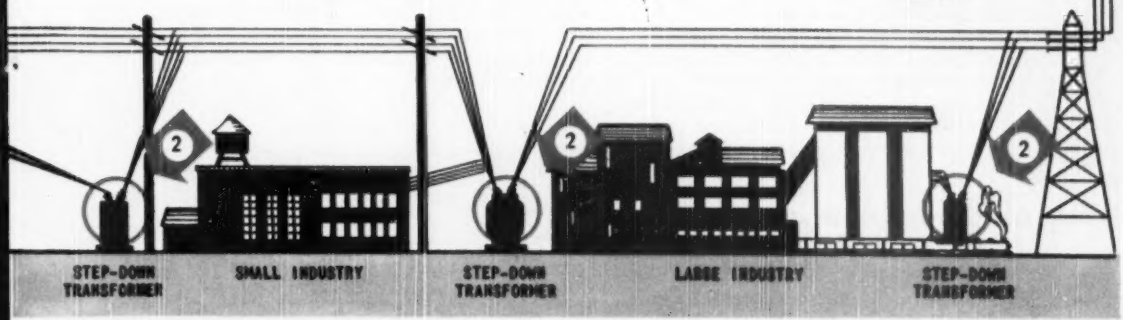
3 Lower installation costs and less maintenance are experienced by utilities that depend on STANDARD for pole type distribution transformers. Rural, urban and commercial services are economically maintained when STANDARD transformers are installed. Accessory protective devices may be selected to meet your individual standard. Every possible need, from power station to consumer, is better met through STANDARD transformers . . . specialists for a quarter century. Write for literature.



OFFICES IN PRINCIPAL CITIES

THE STANDARD TRANSFORMER CO.

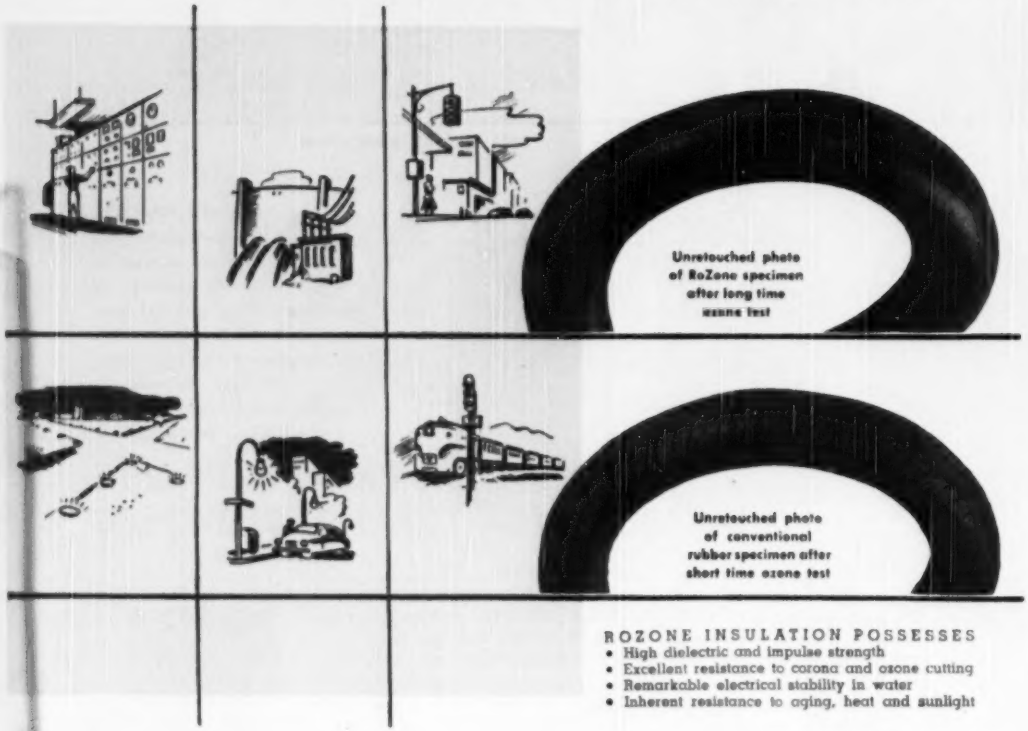
WARREN · OHIO



Rome RoZone

THE SUPERIOR OZONE-RESISTANT INSULATION

adds years to cable life...


Unretouched photo of RoZone specimen after long time ozone test
Unretouched photo of conventional rubber specimen after short time ozone test

ROZONE INSULATION POSSESSES

- High dielectric and impulse strength
- Excellent resistance to corona and ozone cutting
- Remarkable electrical stability in water
- Inherent resistance to aging, heat and sunlight

The photos above tell their own story. At the top is RoZone insulation after being subjected to an ozone atmosphere for a period well in excess of specification requirements. Note that there is no deterioration of compound... no surface checking. Below is conventional rubber insulation after a much shorter ozone test. These unretouched photos demonstrate clearly the superiority of RoZone under conditions of ozone cutting when higher voltages are involved... all of which means longer service life and greater dependability.

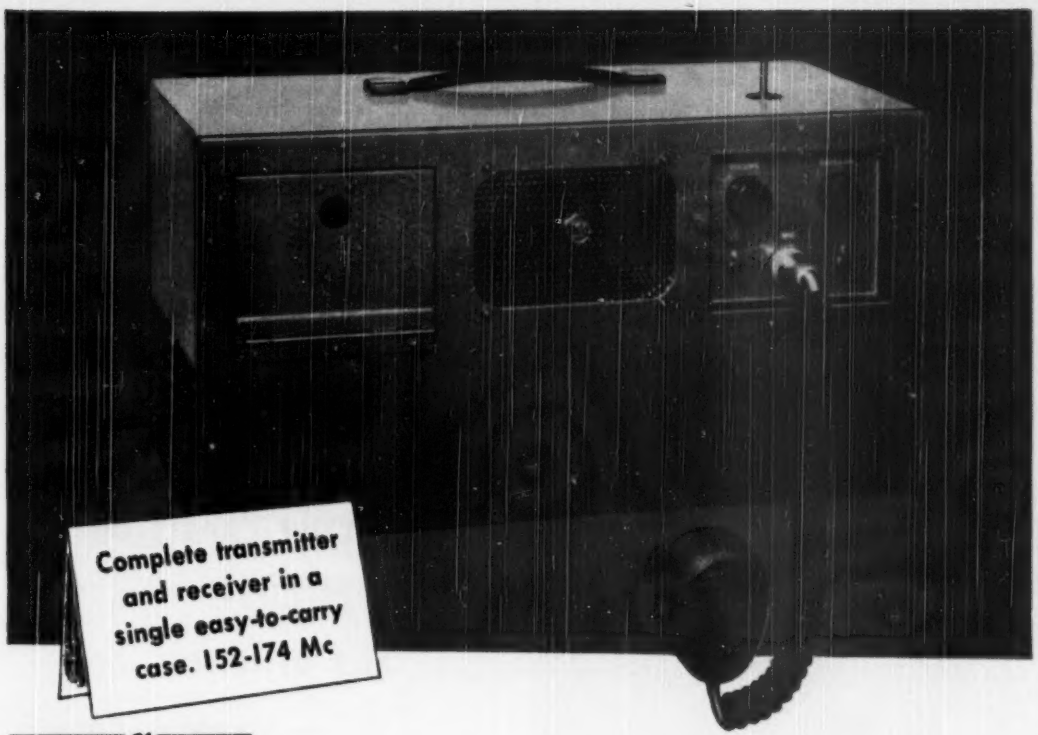
Specifying RoZone pays off on many installations. For example, high voltage power circuits... station or supervisory control signal cables... street lighting cables... airport lighting and control cables as well as general purpose wiring where high quality and long life is paramount.

Write for specification RO-4 today and see why leading utilities, industrials and railroads are specifying RoZone.

It Costs Less to Buy the Best...
Buy Rome RoZone

ROME CABLE
Corporation
ROME · NEW YORK
From Bar to Finished Wire

ROME CABLE ROME, N.Y.



IT'S EASY TO CARRY—weighs only 44 pounds. The case is only 19¾" long, 10⅝" high, and 9¼" deep.

IT CAN BE SET UP ANY PLACE where there's a 115-volt, a-c supply—forestry, utilities, construction projects, etc.

IT'S IDEAL for 2-way operation (police, fire, etc.) in small and medium-size municipalities requiring medium-range communication equipment.

For *portable or fixed* station use

. . . the RCA Carfone Station Unit "15"

THIS is the most versatile 2-way radio station ever designed for medium-range communication. It is complete with transmitter, receiver, power supply, portable antenna, handy microphone, and loud speaker—*all in a single package.*

Easy to carry and easy to set up, this portable unit can be operated wherever there is a 115-volt, a-c outlet.

For fixed station use, place the unit on the operating desk, hook-up the antenna, plug in the power cord, and you're set to go. For portable station use, simply connect the quarter-wave, whip antenna (supplied) and plug in the power cord. No extra components to carry around. No installation expense involved.

Greatly improved receiver selectivity reduces adjacent channel signals well below interference levels. A newly-designed transmitter modulation control enables you to transmit the full signal potential of the transmitter and maintain 100 per cent modulation at virtually all voice levels — *whether you shout or whisper into the microphone.*

For complete information on the new RCA Carfone Station Unit "15", write Dept. 31B, RCA Engineering Products, Camden, New Jersey.

RCA

MOBILE COMMUNICATIONS SECTION

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

Jack of ONE trade

—and MASTER of it!

CORNELL-DUBILIER

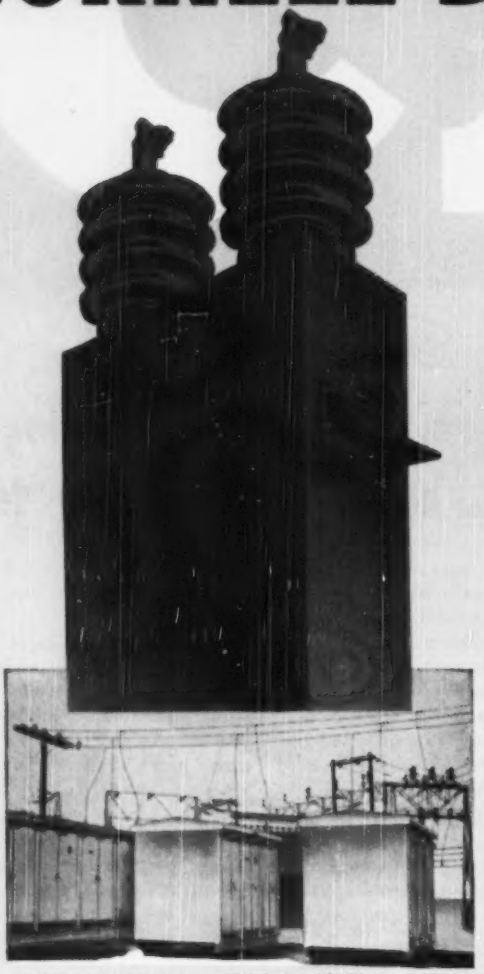


Photo showing section of a 37,640 Kvar, 12,470 Volt, WYE, isolated neutral, station-type C-D capacitor installation.

THE POWER-FACTOR CAPACITOR SPECIALIST FOR UTILITIES

More than a decade ago, C-D installed its first power-factor capacitor installation. It's given trouble-free service ever since. During the intervening years C-D capacitors have rolled up a record of better than 10-years average service on utility systems and in manufacturing plants throughout the world. Specialization has enabled us to produce a better power-factor capacitor.

Our engineers will be glad to discuss with you the advisability of a capacitor designed for your specific needs. Your inquiry is cordially welcomed. Cornell-Dubilier Electric Corporation, Dept. D20, So. Plainfield, New Jersey. Other plants in New Bedford, Worcester, Brookline, Mass.; Providence, R. I.; Indianapolis, Ind. and Cleveland, O.

Follow the leaders

Demand dependable C-D Capacitors —built by capacitor specialists.

C-D Best by Field Test!

1910 1950

Reg. U. S. Pat. Off.

CORNELL-DUBILIER WORLD'S LARGEST MANUFACTURER OF CAPACITORS

"GOOD STREET LIGHTS

make better home towns"

Says **C. B. McManus,** *President*
Georgia Power Company
Atlanta, Georgia

"THE Georgia Power Company has won national recognition for its Better Home Towns Program. Good street lighting is recognized as an invaluable aid to public safety and crime prevention. Equally important, I think, is the fact that it makes the citizens of a town take more pride in themselves and their community. Consequently, we are promoting such a program actively not only in Atlanta and other large cities but also in the many small towns we serve."

FOR MORE FACTS—*Write for your free copy of "Planned Progress in Street Lighting."*

The Street and Traffic Safety Lighting Bureau, 155 East 44th St., New York 17, N. Y.

every reel rolls up new savings...

WHEN YOU USE

REYNOLDS ACSR

More and more budget-minded operators are including Reynolds ACSR in their 1950 programs. It slashes costs right from the start because the initial price is considerably lower than copper. In the field, savings continue to mount. This lightweight, high strength conductor can be strung faster and easier—cuts pole costs by permitting use of greater spans without increase in sag.

But why not get this great savings story first hand? Prices and complete product data are yours for the asking. Call the Reynolds field office listed under "Aluminum" in your classified telephone directory.

PREFORMED ALUMINUM ARMOR ROD

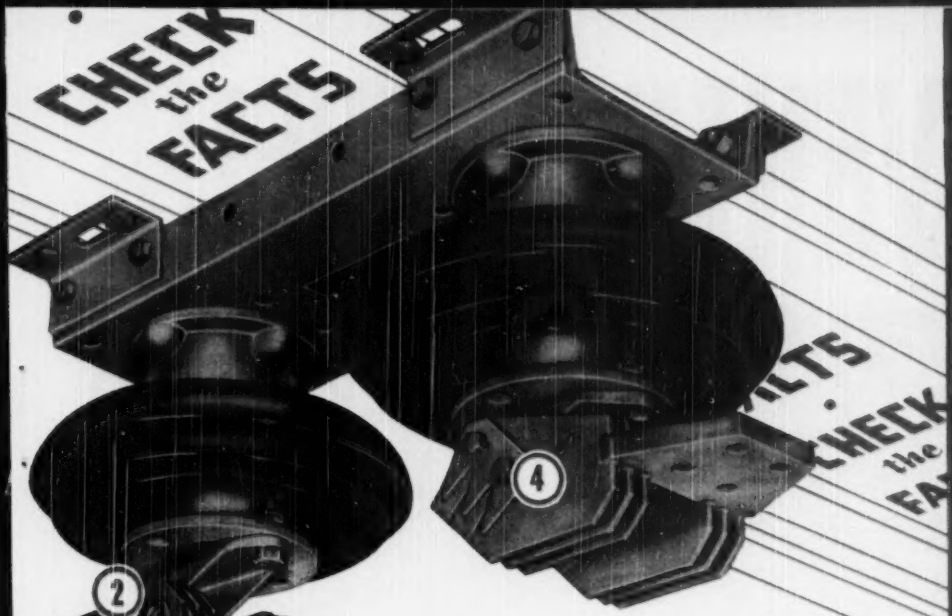
Use of preformed aluminum armor rod with Reynolds ACSR is recommended. It has no magnetic power loss; is longer lived and minimizes the possibility of corrosion. Especially on the smaller sizes, preformed aluminum armor rod has proved easier and more economical to install . . . eliminating need for clips, clamps and special tools.

Through research, Reynolds has determined which is the most suitable, strong aluminum alloy for this service. For complete information, write to Reynolds Metals Company, Louisville 1, Ky.

REYNOLDS METALS

REYNOLDS *Lifetime* ALUMINUM

CONSIDER ALUMINUM • CONSULT REYNOLDS • THE COMPLETE ALUMINUM SERVICE



Because you demand your switches **RUGGED..**

1. **CONTACT**—Hi-Pressure spot-cleans as it wipes as it closes. High conductivity to withstand short circuit stresses.

2. **HINGE**—Hi-Pressure, annular line contact—seals against dirt, always constant in any blade position. Uniform pressure washer maintains contact pressure with less critical adjustment than ordinary cup spring washer.

3. **BLADE LATCH**—Positive protection against short circuits. Combined lock and pryout operated with eye hook.

4. **PRESSURE CLIPS**—Phosphor Bronze individual spring clip for each Spot Contact on blade.

5. **BLADE OPERATION**—Sequence movement. Blades released from contact pressure in pairs to reduce operating effort.

Above, type HPS, 3000 Ampere switch in open position—showing how outer pair of blades have progressed slightly beyond inner pair during sequence operation.

RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA—EASTERN POWER DEVICES LIMITED, TORONTO

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

SYLVANIA'S FULL PROGRAM

1. ELECTRIC LIGHT BULB SALES!

The quick-turnover Spring Package!

• For "Light" Housecleaning Time—the new Sylvania Spring Package—a carefully selected assortment of only the *fastest-selling bulbs*. All dealers do is sell 30 4-pack units and 4 150-watt bulbs and they've sold all 124 bulbs in the Spring-theme Quick-Turnover Package!

You sell a complete bulb department yet you handle only one case at a time. Clean up with Sylvania's Quick-Turnover "Light" Housecleaning Promotion.

FEATURING THE HANDY 4-PACK!

The BIG FEATURE of this colorful promotion is the sensational Handy 4-Pack unit that sells *4 bulbs at a time*. One of the greatest ideas for boosting the unit of sale, the Handy 4-Pack will really do a job for every one of your dealers—*and for you!*

ADS sell SHOPPERS on SYLVANIA BULBS

Entire campaign is backed by strong 2-color national advertisements in outstanding magazines—*The Saturday Evening Post, Good Housekeeping, Better Homes & Gardens*—building all-around consumer acceptance, building SALES!

Bright Spring-theme point-of-sale aids!

Eye-catching window pennant or carton wrap-around!

Hanging pennants to sell impulse shoppers!

Colorful easel card or carton backdrop display!

ADS sell your DEALERS on SYLVANIA BULBS

Right now big trade ads are telling your Grocery, Drug, Hardware, Electrical and Chain Store customers all about Sylvania's "Light" Housecleaning Campaign. Back the ads that are backing you by promoting this campaign!

This Retail Plan Book (1-447) is especially prepared to give you full details about the big Spring Package; ads to your customers and theirs; details on 60-lamp retail case, and information to help you build sales! Write Advertising Dept. L-2402B, 500 Fifth Ave., New York 18, N. Y.

SYLVANIA

ELECTRIC LIGHT BULBS; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES,—

BUILDS SALES FOR YOU!

2. FLUORESCENT LIGHTING SALES!

Complete fluorescent lamp and fixture NATIONAL ADVERTISING

• Big 2 color ads in *Saturday Evening Post, Collier's, Business Week* are now telling prospects and customers all about Sylvania "Fluorescent At Its Finest!" How they can obtain complete packages of light—fixtures and lamps—from one manufacturer at one high quality.

They tell them, too, about the wonderful new Sylvania Triple-Life Fluorescent Lamps that have an average rated life three times that of previous lamps! How Sylvania field-tested over 11,000,000 of these lamps and proved they are unsurpassed!

...and testimonials like these make sales ammunition for powerful ads!

"your rated life expectancy has been exceeded..."
—The Gabriel Company

"last much longer than other fluorescent lamps"—Continental Air Lines, Inc.

"...outlast other lamps which we have operated alongside them"—Pitman-Moore Company.

"a welcome bonus in the battle to keep costs down"
—Pequot Mills.

HUGE TRADE ADVERTISING CAMPAIGN

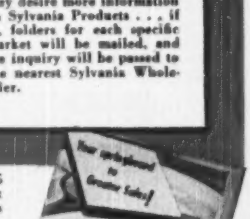
Behind Sylvania's wonderful, new Triple-Life lamps . . . in addition to the complete lines of Sylvania Fluorescent Fixtures . . . is a comprehensive advertising program that hits every important market . . . stores, plants, offices, schools, the contractors and architects . . . through such publications as *Retailing, Women's Wear, Chain Store Age, Mill & Factory, Factory Management and Maintenance, Institutions, School Executive, Contractor's Electrical Equipment, Electrical Construction and Maintenance, Qualified Contractor, Architectural Forum, Progressive Architecture, Electrical World, Lighting & Lamps.*

Folders tie-in with ads . . . *OPEN NEW ACCOUNTS*

During this campaign, stores, plants, offices, schools—your prospects and customers—will be solicited by mail, asked if they desire more information on Sylvania Products . . . if so, folders for each specific market will be mailed, and the inquiry will be passed to the nearest Sylvania Wholesaler.

ELECTRIC

This Plan Book FL-405 for greater fluorescent lamp and fixture sales gives complete information about Sylvania's big advertising programs; direct mail programs; and includes big section on "Turning Prospects Into Profits." Write Advertising Dept. L-2402A, 500 Fifth Ave., N. Y. 18, N. Y.



– SIGN TUBING; PHOTOLAMPS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

Are you walking a tightrope between wood preservatives?

IF THERE's any doubt in your mind about which method of wood preservation to use on your job, think this over:

No other preservative can match the records of long-lasting protection of creosote oil.

And here's another point to remember:

The amount of wood treated each year with creosote oil is many times the amount treated with all other preservatives combined.

For unvarying uniformity of product, adequate penetration and high toxicity, use or specify U·S·S Cresote Oil. Product quality and prompt service are assured you by the extensive facilities of United States Steel.

COAL CHEMICAL SALES DIVISION

UNITED STATES STEEL CORPORATION SUBSIDIARIES

71 Broadway, New York 6, N. Y.

208 South La Salle St., Chicago 90, Ill. 1539 Terminal Tower, Cleveland 13, Ohio
Brown-Marx Building, Birmingham 2, Ala. 25 Beale St., San Francisco 5, Calif.

USS

CREOSOTE OIL

UNITED STATES STEEL

Announcing—ALL NEW—ALL PROVED

INTERNATIONAL TRUCKS

Every model *Heavy-Duty Engineered* to save you money!

Now International puts you squarely in the driver's seat—with a complete new line of completely new trucks!

Every single new International Truck from 4,200 to 90,000 pounds GVW is heavy-duty engineered to give you lower maintenance and operating costs.

Let the facts tell that story:

Fact No. 1: for 18 straight years Internationals have led in sales of heavy-duty trucks (16,001 pounds and over GVW). The men who buy heavy-duty trucks buy on a basis of performance. They choose Internationals.

Fact No. 2: the same management men, the same engineers, the same test experts, the same production men who kept Internationals first in the heavy-duty field, have developed *every* new International Truck.

Every model offers new high standards of comfort and easy handling

Here's relaxing roominess! Here's all 'round visibility! Here's a comfortable, adjustable seat! Yes—you get everything in the Comfo-Vision Cab!

You have full visibility in the one-piece Sweepsight windshield. That convenient two-cluster instrument panel puts everything right in front of your eyes.

And when the truck starts to roll, you find that new Super-steering right for position, and positive control.

AND TALK ABOUT FEATURES . . .

Every new International Truck offers new improvements throughout!

NEW Functional Styling—Smart brawny appearance combines modern design with extreme practicability.

NEW Engine Accessibility—Special fender and hood design provides extra working space between engine and fenders—hoods easily removed.

NEW Brake Systems—hydraulic or air. Faster-acting, surer-stopping, longer-wearing—more efficient braking with less effort.

NEW Outdoor Visibility—Giant, one-piece scientifically curved Sweepsight windshield, large side windows, two rear windows.

NEW Valve-in-head engines—All test-proved for greater power, greater economy, greater stamina, greater efficiency.

NEW Steel-flex Frames—Designed to provide an extra margin of strength combined with the right amount of flexibility.

NEW Comfo-Vision Cab—Model for model "the roomiest cab on the road"—with comfort cushions, adjustable seats, controlled ventilation.

NEW Specialized Transmissions—Types and gear ratios for any job . . . three-speed, four-speed and five-speed with direct drive or overdrive in 5th.

NEW Load-balanced Wheelbases—Shorter wheelbases for standard body lengths provide better load distribution, better maneuverability.

NEW Super-Maneuverability—More positive control from a more comfortable position; new wide-tread axles assure the shortest practical turning circle and greater stability.

NEW Rear Axles for any job—Wider, sturdier rear axles—hypoid single-speed, double-reduction and two-speed with electric shift.

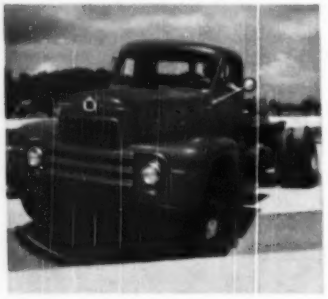
NEW Cradle-Action Springs—Longer springs for greater riding ease . . . stronger springs, sturdier mounting and new spring suspension for longer life.

Plus dozens of new features and refinements throughout every truck!

Proved in the mountains!

Proved on the Belgian Blocks!

Proved in heavy snowfall!



Proved on the twist course!

Every model proved under actual operating conditions!

There wasn't any price tag on the test program to prove the new International Trucks.

It was directed by men whose life work has been to develop better truck transportation. Test drivers were chosen as carefully as you do any key workers. All-outdoors was used for proving grounds. Laboratory analysis tests were backed up by track tests, then by actual road tests. Test convoys were run 'round the clock.

That's why every all-new, all-proved International Truck is right and ready for you *now!*

Call or visit your International Truck Dealer or Branch

International Harvester Builds McCormick Farm Equipment and Farmall Tractors . . . Motor Trucks Industrial Power . . . Refrigerators and Freezers

Tune in James Melton and "Harvest of Stars" NBC, Sunday afternoons

INTERNATIONAL TRUCKS

INTERNATIONAL HARVESTER COMPANY CHICAGO

no tools
no clamps
no concentrated stresses

AND 1/2 THE INSTALLED COST

WHEN YOU PROTECT ALUMINUM CONDUCTORS WITH ALUMINUM PLP ARMOR RODS!

Take half to all the rods needed and lay them across and around the conductor.

Wrap around conductor several times . . . like wringing water from a cloth.

Continue wiping action along conductor.

The finished job.

EASILY INSTALLED in three minutes . . . even by inexperienced linemen . . . Aluminum Preformed Armor Rods protect your aluminum conductor better and at lower cost than ordinary armor.

Better because *only* PLP aluminum rods grip *uniformly* over the *entire* conductor length. Take *full* advantage of aluminum's high electrical and thermal conductivity. Protect best against galvanic corrosion and power loss from magnetic effect.

Less expensive because your linemen make perfect installations *every* time, far quicker than with ordinary armor. Less expensive because *only* PLP rods eliminate concentrated stresses common in other forms of conductor protection.

Complete technical details and installation records are available on ACSR protected by aluminum PLP rods ranging from #4 to 1,590,000 CM. Write to: PREFORMED LINE PRODUCTS COMPANY, 1051 Power Avenue, Cleveland 14, Ohio.

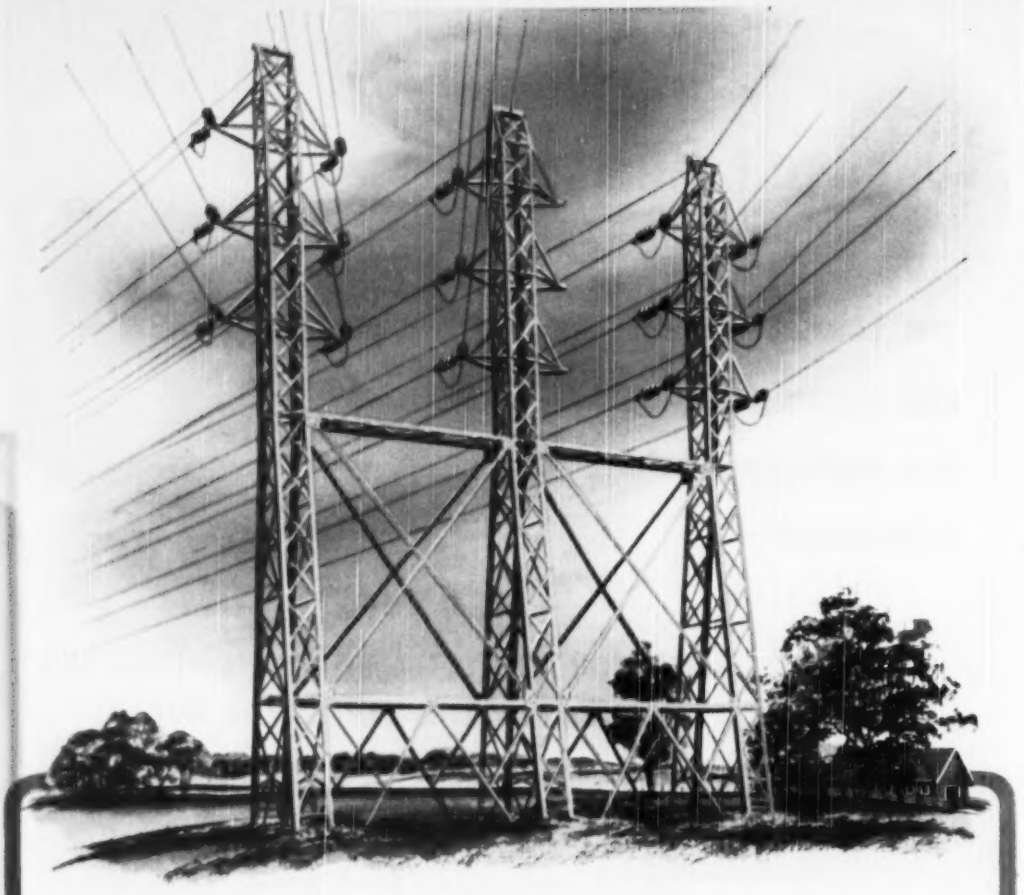
PLP ARMOR RODS ARE ALSO AVAILABLE IN COPPER, BRONZE, COPPERWELD, STAINLESS STEEL AND GALVANIZED STEEL—A TYPE FOR EVERY CONDUCTOR.

Preformed armor rods are for use under patent No. 2,275,019 —other patents pending

PREFORMED

PLP LINE PRODUCTS CO.

1051 POWER AVE. • CLEVELAND 14, OHIO



Hoosier Accepts UNDIVIDED RESPONSIBILITY

Today, more than ever, Hoosier engineers, trained men and special equipment can combine to effect savings in erection and maintenance. Whether your problem is a single unit or a complete new line, Hoosier engineers will accept full responsibility from preliminary plans to completed job. In the past 30 years, scores of America's utilities, large and small, have learned that it is more economical to "call in Hoosier."

HOOSIER ENGINEERING CO.

ERECTION AND MAINTENANCE OF TRANSMISSION LINES

NEW YORK • **1384 HOLLY AVE., COLUMBUS, OHIO** • CHICAGO

USERS SAY G.E.'S 9574 ALL-PURPOSE* INSULATING VARNISH "is tops!"

J. L. Hughes

How do users like General Electric's new all-purpose insulating varnish G-E 9574?

Here's a statement from J. L. Hughes, owner of the J. L. Hughes Electric Company, Columbus, Ohio.

> *"We have found from test and practical experience that General Electric general-purpose varnish 9574 is tops for our work."*

Mr. Hughes knows what he is talking about. He has been in the business of motor repair and rewinding in Columbus for thirty-three years.

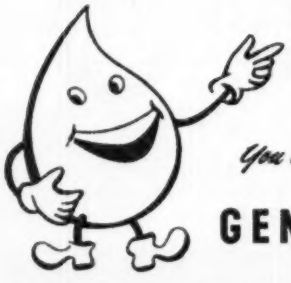
YES, G-E 9574 OFFERS YOU

One varnish you can depend on for ALL* jobs.

A Combination of electrical, chemical and mechanical properties formerly found only in special-purpose varnishes.

Easier Handling: Low baking temperature; deep penetration; simple thinning with petroleum spirits.

**G-E 9574 gives excellent results on all types of coils except extra-high-speed armatures. It is one of G. E.'s complete line of electrical insulating materials, including adhesives, wedges, cements, compounds, cords and twines, sleeving, wire enamels, mica, papers and fibers, permafils, tapes, tubing, varnished cloths, and varnishes.*



SEND FOR BULLETIN! If you haven't yet tried G-E 9574, get in touch with your local G-E Distributor, or write for our new bulletin to Section K1, Chemical Department, General Electric Company, Pittsfield, Massachusetts.

You can put your confidence in

GENERAL ELECTRIC

CIM6-K1

"Quick delivery"... that's only one of the things we mean by Service Plus!

BARS · PLATES
STRUCTURALS · SHEETS
STRIP · REINFORCING BARS
• • •
STAINLESS
ALLOY STEELS
ALUMINUM
• • •
TOOLS · EQUIPMENT
MACHINERY

● Customers tell us that "Quick delivery" and "United States Steel Supply Company" mean the same thing to them. When emergency repairs had to be made or a deadline had to be met, they tested our service and found our "*quick delivery*" usually surpassed their most exacting demands. And in regard to ordinary deliveries, many customers, in a recent survey, wrote "I like your promptness."

"Service Plus" promises you more than speed, however. It is our reminder that we maintain a complete range of steel products, that requests for special products receive special attention, that every order, large or small, gets fast action from experienced personnel, and that you receive courteous, as well as prompt treatment—always.

WHEN YOU DEAL WITH US, YOU GET Service Plus!

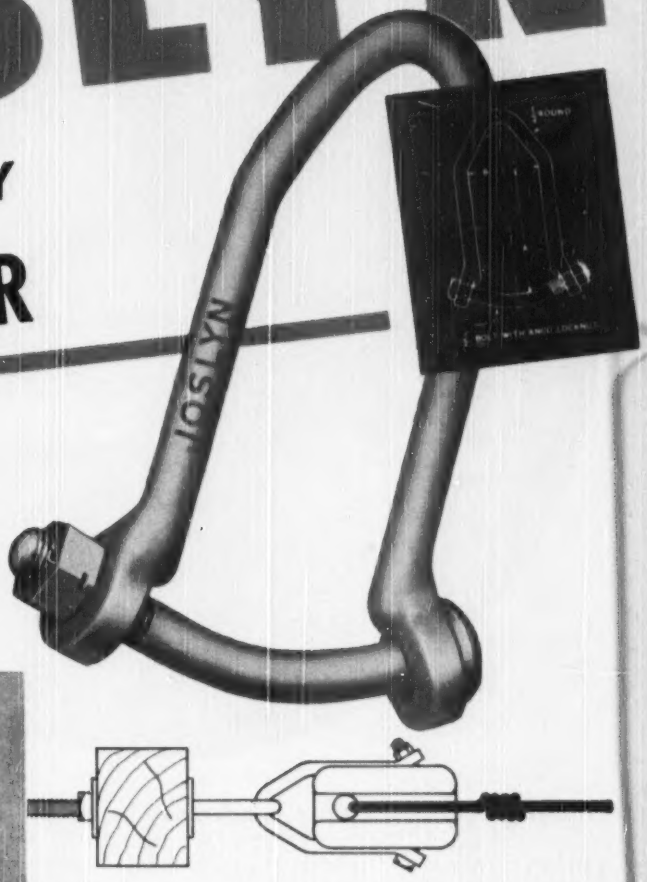
UNITED STATES STEEL SUPPLY COMPANY

Warehouses: BALTIMORE · BOSTON · CHICAGO
CLEVELAND · LOS ANGELES · MILWAUKEE · MOLINE, ILL. · NEWARK · PITTSBURGH
PORTLAND, ORE. · SAN FRANCISCO · SEATTLE · ST. LOUIS · TWIN CITY (ST. PAUL)
Also Sales Offices at: KANSAS CITY, MO. · PHILADELPHIA · TOLEDO · TULSA · YOUNGSTOWN
Headquarters Offices: 208 S. La Salle St.—Chicago 4, Ill.

UNITED STATES STEEL

JOSLYN

HEAVY DUTY INSULATOR CLEVIS



Clevises are made in a complete range of sizes to fit all standard strain insulators.

STOCK NUMBER		DIMENSIONS	
HEAVY TYPE	LIGHT TYPE	A	B
—	J702	4"	1½"
J723	J703	3"	1½"
J725	J705	3"	2"
J726	J706	4"	2"
J728	J708	4"	2½"
J738½	—	4½"	2½"
J729	J709	5"	2½"
J731	J711	4"	2½"
J731½	—	4½"	2½"
J735	J712	5"	2½"

Joslyn Heavy Type Insulator Clevises are drop forged steel, made to the new E.E.I. standard specifications. Both the heavy and light types are assembled with a positive Anco lock nut on the curved bolt. Used in all types of dead ending applications.

Sales offices in principal cities

THE JOSLYN CO.
THE SOUTH EAST JOSLYN CO.
SOUTHERN JOSLYN CO.
JOSLYN SOUTHWEST CO.
JOSLYN PACIFIC CO.

JOSLYN MFG. AND SUPPLY CO.

Complete Pole Line Equipment

2604 NORTH WACKER DRIVE, CHICAGO 6, ILL.

Looking for a Possible Variation in the "Fluff"

Precision in the making of corrugated shipping containers is as essential as in the manufacture of the thousands of products these containers carry safely to their destinations. In the mills of The Ohio Boxboard Company at Rittman, Ohio, the Strobotac checks several manufacturing operations, not the least of which is shown above. Here are the how and the why in their own words:

> "The beam was focused on the single facer where the corrugated medium (.009" straw) left the flute roll and "fluffed" out on the fingers before the adhesive is applied. The "fluff" must be uniform to achieve uniform adhesion, otherwise blisters will form. Even though we had to use a double image, due to the frequency being about 360 per minute, we were able to spot faulty finger adjustment which resulted in blistered board. By use of the Strobotac we were able to correct faulty adjustment very quickly."

Here, as in hundreds of instances, the Strobotac flash, by "stopping motion," reveals conditions and causes, effects and defects, previously hidden or obscured.

TYPE 631-B

STROBOTAC

Direct-Reading Flashing Speed Range: from 600 to 14,400 per minute — stops motion from 100 to 100,000 rpm.

Flash Duration: between 5 and 10 microseconds.

Power Supply: 115 volts, 60 cycles.

Power Input: 25 watts.

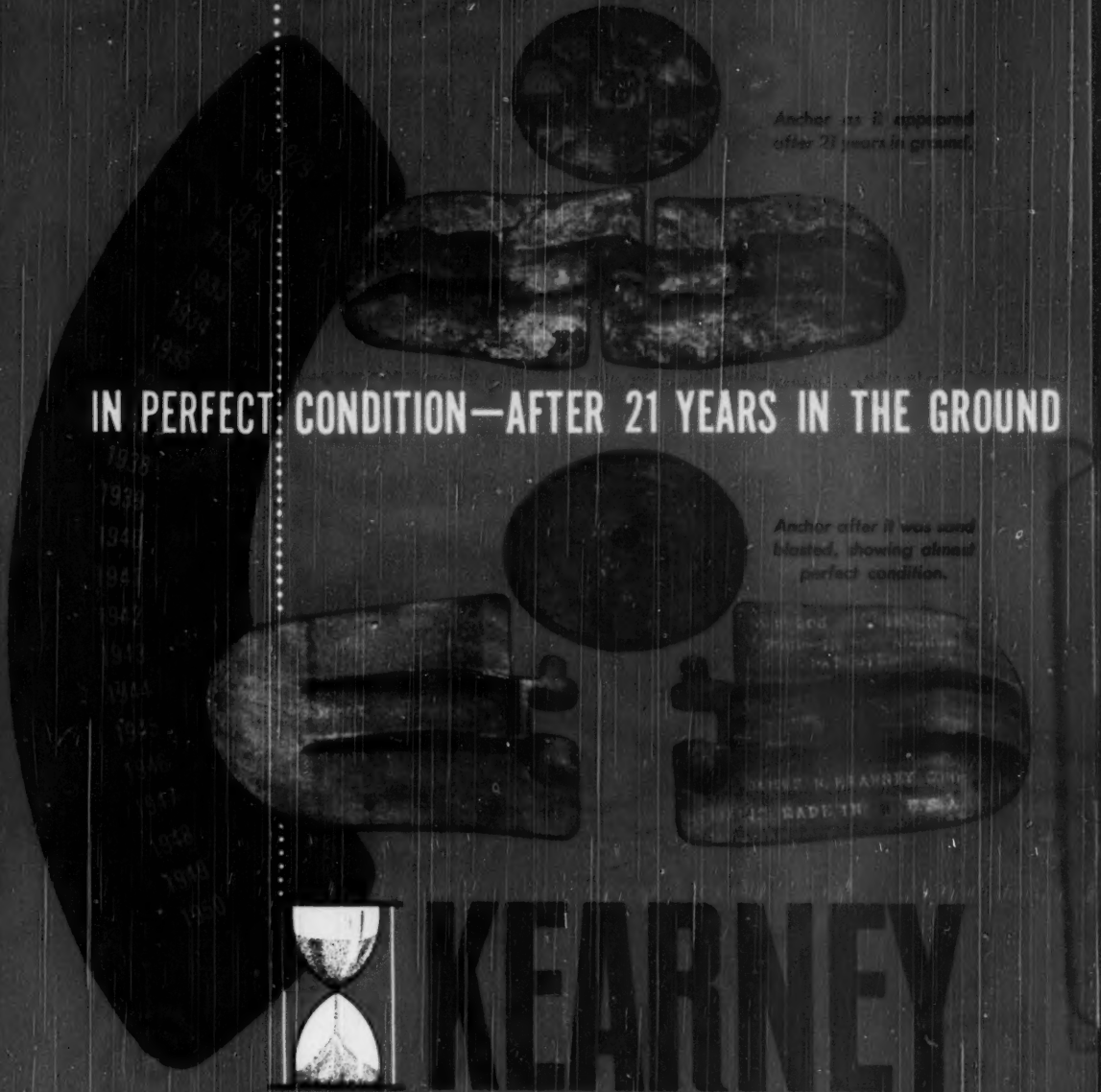
Dimensions: 7½ x 8½ x 9½ inches.

Price: $125.00

Write for your 24 page manual of stroboscopic techniques, "Eyes for Industry."

GENERAL RADIO COMPANY Cambridge 39, Massachusetts

90 West St., New York 6 · 920 S. Michigan Ave., Chicago 5 · 1000 N. Seward St., Los Angeles 38



IN PERFECT CONDITION—AFTER 21 YEARS IN THE GROUND

KEARNEY

QUALITY STANDS THE TEST OF TIME...

Certified MALLEABLE IRON EXPANSION ANCHORS

UNLIMITED SERVICE LIFE—
WILL OUTLAST OTHER CONSTRUCTION MATERIALS

One pole insecurely anchored can cause damage that might cost thousands of dollars in lost power and repair work. In buying anchors it is obviously economical to buy the best. Kearney certified Malleable Iron Anchors have a proven record of performance in all types of soil and there is a Kearney certified Malleable Iron Anchor for every application.

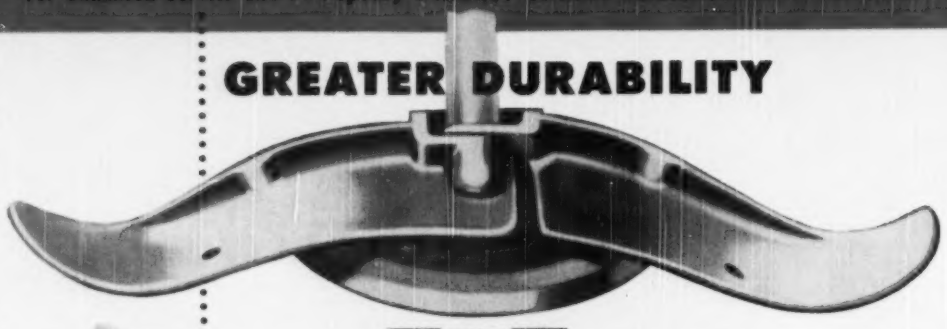
JAMES B. KEARNEY CORPORATION 4216-42 Clayton Ave., St. Louis 10, Missouri

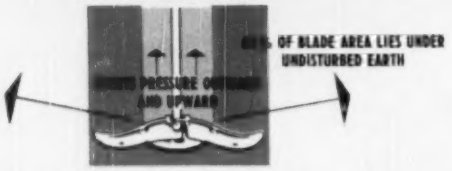
SECURELY GUYED POLES

THE FOUNDATION OF All-Line CONSTRUCTION

For Unlimited Service Life . . . Specify KEARNEY Certified MALLEABLE IRON ANCHORS

GREATER DURABILITY





GREATER HOLDING POWER

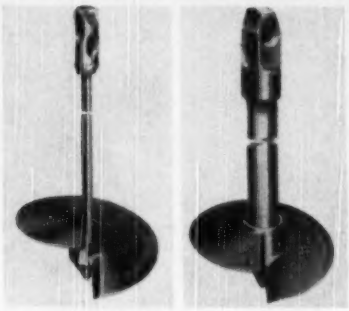
The KEARNEY 2-way type anchor features special blade contour that exerts an outward as well as upward pressure to provide *extra* holding power. Blades expand easily with no disturbance to the earth and 63% of the blade area lies under undisturbed earth. These fundamental advantages are features of the 3 and 4 way types also available.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

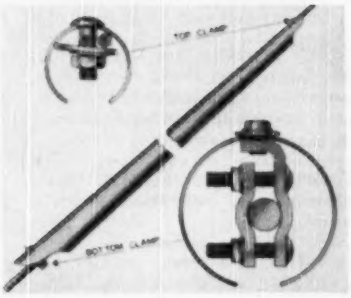
Better Construction — *SAFER* Maintenance

KEARNEY

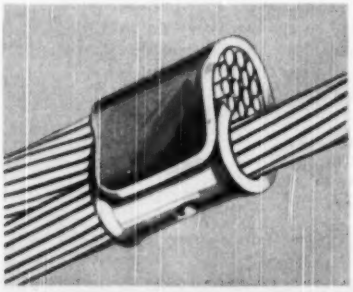
BE SURE YOU USE *Certified* MALLEABLE IRON ANCHORS



The Kearney Steel Rod and Pipe Rod Screw Anchor is also made of certified Malleable Iron. These anchors are for specific application in swamp and muck soil, where it is necessary to bore down a considerable distance before reaching firm earth.



The Kearney FULL-VU GUY GUARD is available in ALL-ROUND and HALF-ROUND and is made from corrosion resistant aluminum to provide greater light reflection for safety. Much lighter than galvanized steel (one-third the weight) this guard is equal in strength to steel.



Kearney GUY-WIRE CLIPS . . . Modern methods of serving up strands require the use of guy wire clips. Kearney clips made of copper or aluminum enable you to do the job in one-fourth the time required in using waste strand. Will not scratch or peel the strand galvanizing.

JAMES R. KEARNEY CORPORATION, 4224-42 Clayton Ave., St. Louis 10, Missouri

fewer replacements
+
less maintenance
+
maximum performance

=a MUST in your planning

LAPP LINE POST

INSULATOR failures cost you: unit replacement + maintenance labor + possible loss of revenue through outage + strained consumer relations. Actual PERFORMANCE records of installations over the past eighteen years show *in every case* that *lines on Lapp Line Posts have fewer outages, require fewer replacements and less maintenance than comparable lines on any other type of insulator.* Rugged punishment-takers, Lapp Line Posts have a *proved record* of only 1% to 10% the replacement rate on pin type insulators, because:

- If severe flashover or rifle attack breaks off a petticoat or two, the body itself does not crack; leakage and flashover distance are lowered only negligibly. *The insulator remains in fully effective service!* (Contrast with the fragility of shell-type insulators, and the fact that loss of a single shell costs 35% or more of their electrical characteristics.)
- Rugged one-piece construction makes it *impossible* for Lapp Line Posts to crack under tension caused by relative thermal movement—a common reason for failure in multi-part insulators.
- Lapp Line Posts are self-cleaning, eliminating maintenance, increasing efficiency.

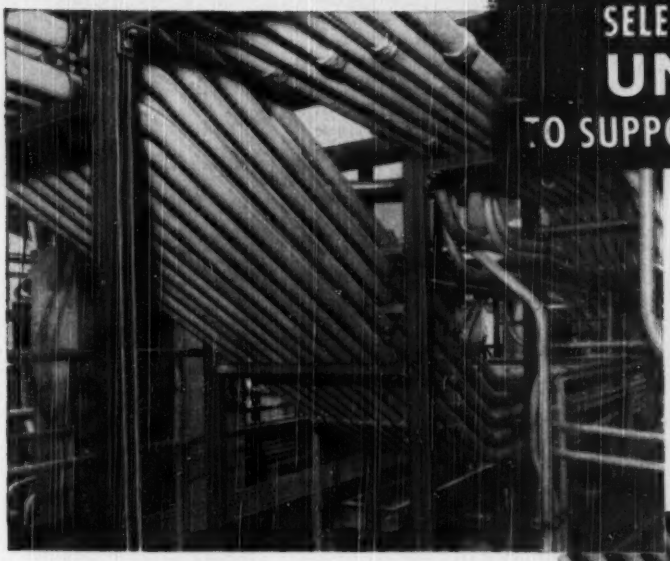
For dependable service, punishment-absorbing durability, maximum PERFORMANCE—all adding up to economy—no other insulator can match the *proved* record of Lapp Line Posts. Put them to work for you. They'll be yours for life.

PERFORMANCE IS PROOF

Lapp INSULATORS

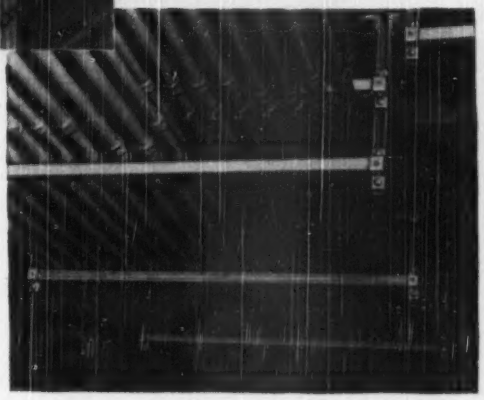
PACIFIC GAS & ELECTRIC CO.

SELECTS VERSATILE UNISTRUT TO SUPPORT CONDUIT RUNS



Completely adjustable Unistrut simplifies the most difficult problems of supporting complex conduit runs used in distribution systems—permits fast, on-the-job framing assembly where all adjustments are made by just loosening a bolt, and where supporting members are added as work progresses. No drilling, no welding, no special tools or equipment. Saves time—cuts costs. Try Unistrut on your next job to see how much quicker, better and more economically the work can be done.

Heavy rows of conduit are quickly installed and easily supported with completely adjustable Unistrut channel, fittings and clamps. Note examples of combination racking where conduit is clamped above and below to channels mounted back to back.



UNISTRUT—is metal channel with a continuous slot. You simply insert the Unistrut spring nut into the channel at approximate point where attachment of another framing member is desired, slide to exact location and bolt to Unistrut fitting. Nut is thus secured firmly to "double track" formed by inturned edges of channel to provide positive clamping action, prevent slippage.

Unistrut includes concrete inserts, pipe, tubing and cable clamps, roller pipe supports, brackets, and many other standard parts which in combination provide the world's most flexible system of support or suspension. With Unistrut you can build all types of framing, mounts, shelving, racks, tables and benches, cable, conduit and pipe hangers, fluorescent fixture supports and many other structures with only a hacksaw and a wrench. Unistrut does the complete job, you need no other parts or materials.

Write today for Free Sample of Unistrut and these Catalogs.

Catalog 500: Construction uses of Unistrut—supports, frames, mounts, etc.

Catalog 600: Materials Handling uses of Unistrut—racks, bins, etc.

THE 3 QUICK UNISTRUT STEPS

1. Insert Nut into Channel

2. Locate Fitting and Nut

3. Tighten Bolt —it's done

U. S. Patent Numbers
2327587 2380379
2363382 2345650
2329815 2405631
Other patents pending

UNISTRUT
The World's Most Flexible All-Purpose Metal Framing

Prompt Delivery from Warehouse Stocks in Principal Cities, Consult your Telephone Directories

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd. • Chicago 7, Illinois

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd., Chicago 7, Ill., Dept. W-2

Please send free sample of Unistrut and catalogs checked below without obligation.

Catalog 500 ☐ Catalog 600 ☐ Unistrut sample ☐

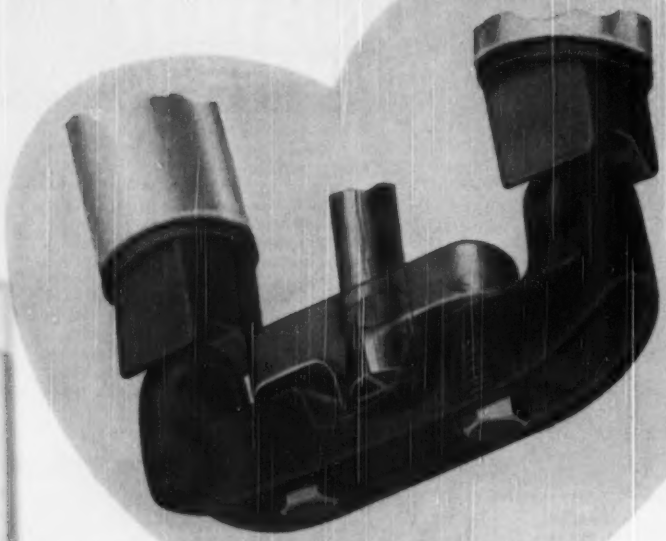
Name_____

Company_____

Address_____

City_____ Zone____ State_____

LET'S GET TO THE HEART OF THINGS



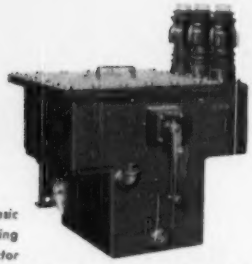
and this means CONTACTS in a SWITCH

This simple, effective, HIGH PRESSURE contact link is the heart of G & W Type "PK" Load Break Oil Switches. The ball and groove contacts are self-aligning and need no arcing tips. Two coil springs in each link maintain firm contact pressure and increase speed of opening when the operating lever is turned past dead center. Switching arc is quickly quenched by oil forced into the gap through holes in the link contact.

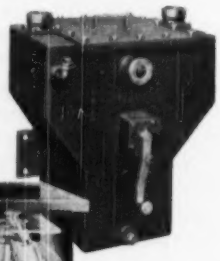
Type "PK" switches are made in several styles for use as single throw, multipole load break switches. The switches are easily adapted for remote lever or push button operation and the operating lever may be locked in either position. The entire switch assembly may be removed from the tank as a unit.

All "PK" switches are made fully oil and water tight by using "Resistoyl" gaskets for all joints and a rotary oil seal for the operating lever shaft. The one piece welded steel tanks are pressure tested at the factory and are fitted with a valve for easy air pressure testing in the field.

Write us or our representatives for further information.



This adaptation of the basic "PK" switch uses one wiping sleeve for three conductor cable entrance and disconnecting potheads for isolating switch from vault bus. Standard units are 7500 volts—200 & 400 amperes.



Type "OPK" switches use the basic "PK" switch assembly in a tank designed for class 1, Group D, hazardous location installation. The tank height is increased to provide 6" of oil above the topmost live part. Standard unit is 5000 volts, 400 amperes.

Type "PKL" switches are for use where safety regulations require a visible air break in series with an oil break. For complete safety in operating, the air link plugs are removed through a plastic covering to obtain an air separation between switch contacts and cable terminations. Standard unit is 7500 volts, 300 amperes.

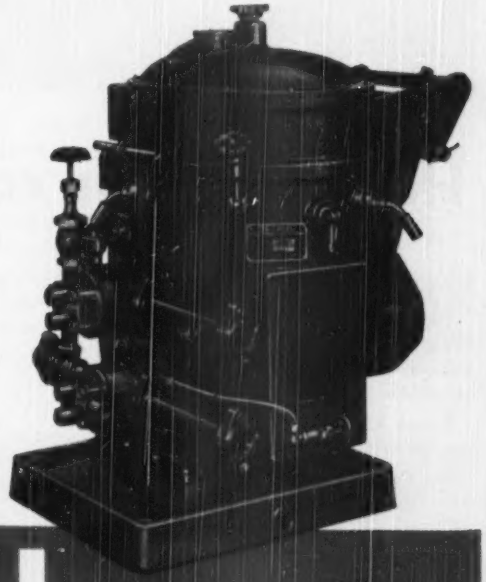
G & W ELECTRIC SPECIALTY COMPANY.
7780 DANTE AVENUE • CHICAGO 19, ILLINOIS, U.S.A.
Representatives in principal cities. In Canada, Powerlite Devices, Ltd., Toronto

I STOP TROUBLE before it STARTS!

"I am De Laval Centrifugal Force. I am expert at removing dirt and water from lubricating oil — either turbine lube or Diesel lube. And because dirt and water are the chief causes of lubricating oil deterioration, I actually guard your power plant against trouble. I stop trouble where it counts — ***before*** it happens."

De Laval Centrifugal Force does its job thoroughly. The water is continuously discharged after being removed from the oil by centrifugal force, and the dirt is stored in the bowl, outside the zone where purification takes place.

De Laval Oil Purifiers offer still another advantage to plant operators — these machines have enough reserve capacity to take care of a sudden emergency, such as a surge of water due to a leak.



THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval OIL PURIFIERS

Help for your conductor problems

Call a Kaiser Aluminum engineer.

He will study your problems and bring you sag and tension charts, staking and stringing sag tables, and a bookful of other data.

Kaiser Aluminum Conductor engineers have compiled them to answer your problems . . . tailor-made to help you complete your project efficiently and economically.

This engineering service—precise and individual—saves you money and makes certain that Kaiser Aluminum Conductor gives you the best on-the-job performance.

Just call a Kaiser Aluminum engineer on *your* conductor problems!

Kaiser Aluminum Conductor is produced by Kaiser Aluminum & Chemical Corporation.

Kaiser Aluminum

CONDUCTOR

SOLD BY KAISER ALUMINUM & CHEMICAL SALES, INC., KAISER BUILDING, OAKLAND 12, CALIF. . . . . OFFICES IN:
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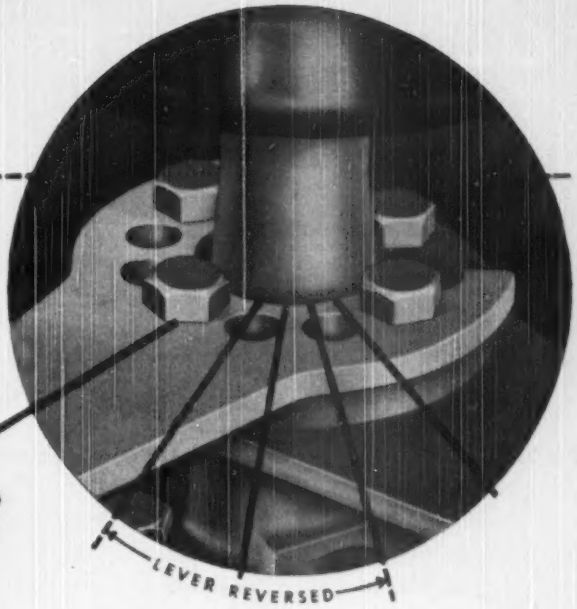
Wichita • *Also available through General Electric Supply Corporation, Westinghouse Electric Supply Co., and Line Material Co.*

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



Asymmetric drilling of 30° mounting holes in the new Universal Mounting Lever enables it to be set at 15° intervals—within 7½° of the desired angle.

15° ANGLES make switch mechanisms universal

Now you can order your disconnecting switches complete with operating mechanisms at the time your structure is planned. No need to wait for final details to be worked out. Just order Westinghouse Type V Switches with the Universal Mechanism—and you can be sure they'll meet any but the most unusual arrangements. That's because the new operating lever can be set within 7½° of any desired angle to provide easy operation.

Here is another place where attention to little things makes the Westinghouse Type V Disconnecting Switch the biggest dollar value on the market today. Get the benefits of experience and top-grade switch design in your system. Install the Westinghouse Type V.

For complete information on the Type V, or on the entire Westinghouse switch family, get in touch with your nearby Westinghouse office or distributor. Ask for B-4241 and B-4242. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-60701

Westinghouse

TYPE V

DISCONNECTING SWITCHES

MOTOROLA "RESEARCH" LINE OF F.M. 2-WAY RADIO

chosen again

and again by city after city for superior adjacent channel performance

TYPICAL REPORT: "In compliance with test requirements, Motorola Inc., installed three 250-watt fixed station transmitters (on 155.73 mc.; 155.79 mc.; 155.85 mc.). The Motorola mobile equipment selected the 155.73 mc. station in all conditions with good results. No reception of the adjacent channel station was noted even when the mobile unit was operated in the immediate vicinity of the other transmitter."

CITY OF BUFFALO

LAKE COUNTY

CITY OF

CITY OF MEMPHIS

CI

ILWAUKEE

ROCHESTER

VALLEJO, CAL.

ILLINOIS

REPORT (CONTINUED)

"These tests preclude and safeguard us against future possibility of interference from any other transmitters that may be set up."

"Car to car tests exceeded all reasonable demands for car to car operation in emergency services."

"Collectively the tests have proven that Motorola equipment will amply provide for a modern communications system for our fire and police departments, not only at the present but in the future."

"RESEARCH" LINE OF F.M. 2-WAY RADIO with revolutionary new developments engineered at Motorola—the World's largest laboratories devoted exclusively to the development of radio communications systems—specialists in this field for over twenty years.

Compare Motorola with any other equipment. Write today for complete details.

GOOD POLICY

protection . . . *of your long-term investment.* PROTECTION *against obsolescence for many years to come.*

Specify Motorola *"Research" Line for permanence in* FM 2-WAY radio *operation.*

Motorola

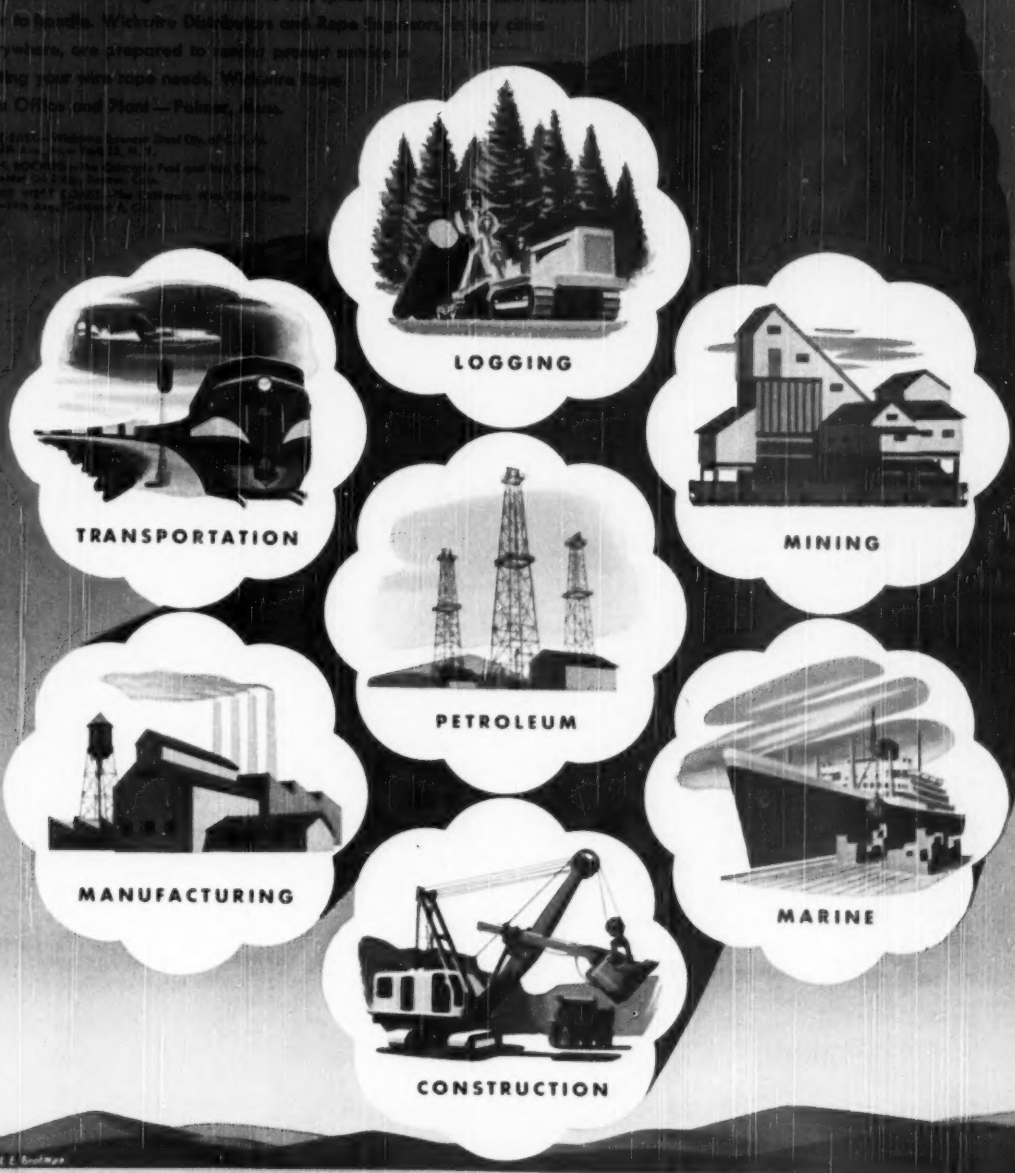
Communications & Electronics Division • 4545 W. AUGUSTA BLVD. • CHICAGO 51, ILLINOIS

WICKWIRE ROPE

A PRODUCT OF CF&I

Ask any user . . . you'll find them everywhere

In scores of industries, users of Wickwire Rope have developed an affection—almost—equal to its performance, safety and long life. And, for free economy, they use Wickwire WISSCOLAY® *Preformed*. It lasts longer—is easier to cut, splice and install. It's kink-resistant and safer to handle. Wickwire Distributors and Rope Engineers, in key cities everywhere, are prepared to render prompt service in meeting your wire rope needs. Wickwire Spencer Steel Div. of CF&I Sales Office and Plant—Palmer, Mass.



STACKPOLE

CARBON • GRAPHITE • MOLDED METAL

Engineering News

FIRST AID FOR A LOT OF CONTACT TROUBLES

Having trouble getting contacts for long life and low contact resistance on continued operations where heavy arcs exist, or under closed conditions? Then Stackpole Silver-Tungsten Contacts are probably the answer to your problem—whether it applies to a circuit breaker, motor controller, transformer protective device, aviation relay, contactor or similar equipment that requires an extremely durable contact.

TYPICAL STACKPOLE SILVER TUNGSTEN GRADES

Grade	Tungsten Silver % Silver	Cross Breaking Strength Lbs. per Sq. in.	Hardness Rockwell Superficial	Density	Electrical Conductivity Ag = 100	Contact Resistance Estimated Ag = 100
EW56	70	57,000	15T75	12.0	75	120
EW48	50	82,000	30T56	13.2	55	150
EW41	35	108,000	30T72	14.6	45	200
EW34	32	115,000	30T70	14.7	40	250

Only a few standard types are available. Best results are obtained by laboratory testing of contact mixes containing different percentages of silver and graphite. These tests are made on the actual device under operating conditions—a service Stackpole gladly renders to makers of original electrical equipment. Write for details.

NEW! INEXPENSIVE *3* AMPERE SNAP SWITCHES

These sturdy little switches meet the need for units having sufficient current-carrying capacity for electrical toys, appliances and similar equipment. SS-26 is single-pole, single-throw and SS-26-1 is single-pole, double-throw. Both are rated at 3 amperes at 125 V. AC or 1 ampere at 125 V. DC. Both are Underwriters approved. Designed and constructed for long, dependable service, they are available at low cost. Samples on request to quantity users.

PUMP SHAFT MECHANICAL SEALS

Pump or compressor seals molded from suitable mixtures of carbon, graphite or carbon-graphite offer distinct advantages, for many applications. In contrast to the ordinary "packing type" seal, these molded Stackpole *mechanical* units seal the shaft tightly and *without any wearing surface bearing on it.* This prolongs shaft life while assuring greater operating efficiency. In addition, Stackpole molded seals are unexcelled for difficult applications where a tight seal must be maintained under high pressure conditions.

Mechanical seals can be molded to close tolerances and to a variety of shapes. As amply proved by Stackpole's broad experience, they are ideal for many different shaft sealing applications. Write, giving details of your application for specific recommendation.

WELDING OR BRAZING CARBON ELECTRODES *that last 3 to 4 times as long*

UNTREATED after 500 brazing operations

STACKPOLE "F" TREATED after 1300 similar operations

Here's where you can make a substantial saving, reduce machine "outage" time while tips are being dressed or changed, increase welding and brazing efficiency.

Stackpole's famous "F" treatment (which minimizes oxidation) produces tips that operate at temperatures above red heat, require dressing less than one-third as often, and last from 3 to 4 times longer than ordinary, untreated tips. On a typical high-temperature job where conventional carbons were changed hourly, Stackpole "F" treated carbons lasted all day and required dressing only about one-third as often. Write for samples, stating size and shape. Mention company connection.

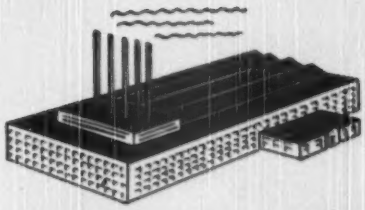
Write for this CARBON SPECIALTY ENGINEERING DATA BOOK

More than a catalog, Stackpole Booklet 40 contains a wealth of data to help you evaluate the electrical, mechanical or chemical advantages of carbon, graphite or carbon-graphite on a long list of applications. Write for copy today on your company stationery.

STACKPOLE CARBON COMPANY • ST. MARYS, PA.

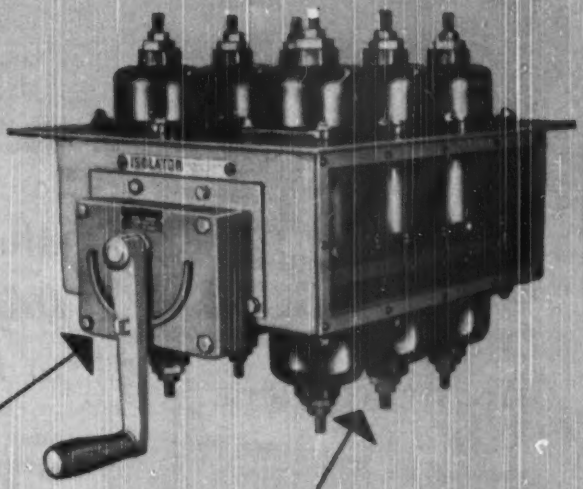
"EVERYTHING IN CARBON BUT DIAMONDS"

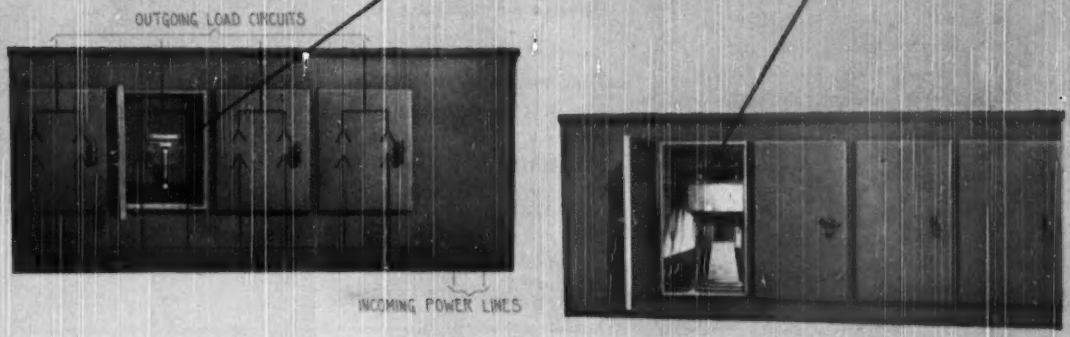
Modernizing with ISOLATORS



A large industrial plant has just completed the modernization of their power distribution system. Only the most up-to-date equipment and methods were used. As regards the high voltage switching equipment it is only natural that the engineers* selected ISOLATORS. Upward to twenty-three pole ISOLATORS were used, some being of the disconnect and some of the interrupter type.

The Isolator as built exclusively by "Three E" is primarily a safety-first device. In addition it has many other desirable features such as saving of space, elimination of insulating barriers and other materials which must be used if open blade switches are employed.





Front and rear view of metal clad load center equipped with 3 P.D.T. 200 ampere 5000 volt disconnect ISOLATORS. Power is fed to center from two sources. *Kelso-Burnett Electric Co., Engineers and Contractors, Chicago, Illinois.

If you are planning a new high voltage distribution system, switching center or vault, investigate the ISOLATOR.

Ask for bulletin 140 on disconnect type and bulletin 138 on interrupter type.

THREE E — ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

MALLORY TUNGSTEN CONTACTS

Although all Mallory tungsten is chemically the same, the size, shape and distribution of the grain particles are carefully controlled, since these factors vitally affect its electrical and mechanical properties. Mallory will gladly work with you to find the right contacts to meet your specifications. Write today.

Mallory Contact Know-How *Drives Customers' Costs to Rock-Bottom Level!*

Big savings for customers are the order of the day . . . and more and more of these savings are resulting from Mallory contact recommendations.

In the case of a manufacturer of ignition distributors, Mallory began making a whole contact assembly, slashing the cost of one important component alone by 50%! In addition, Mallory refined certain production techniques for an additional large saving.

That's value beyond expectations!

Mallory contact know-how is at your disposal. What Mallory has done for others can be done for you!

In Canada, made and sold by Johnson Matthey & Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Electrical Contacts and Contact Assemblies

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Capacitors	Contacts
Controls	Resistors
Rectifiers	Vibrators
Special Switches	Power Supplies

Resistance Welding Materials

DISTRIBUTION

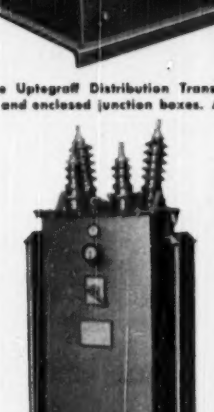
The Dependability you demand, in the types and sizes you need.

Long life and dependability are built into Uptegraff Distribution Transformers through sound design and rugged construction. Available in sizes from 1½ to 500 KVA, up to and including the 69 KV Class. Types include air-cooled dry types, as well as oil or askarel immersed transformers. The units shown here are representative of Uptegraff designs.

Uptegraff is well-equipped to promptly serve individual specialized needs as to capacity, rating and dimensions. We will be glad to have our nearest representative call at your convenience, to discuss your transformer problems.

Large Uptegraff Distribution Transformer, with radiators and enclosed junction boxes. Askarel immersed.

Large air-cooled distribution transformer, for indoor service.



Type HD Transformer, with special base and valve guard.

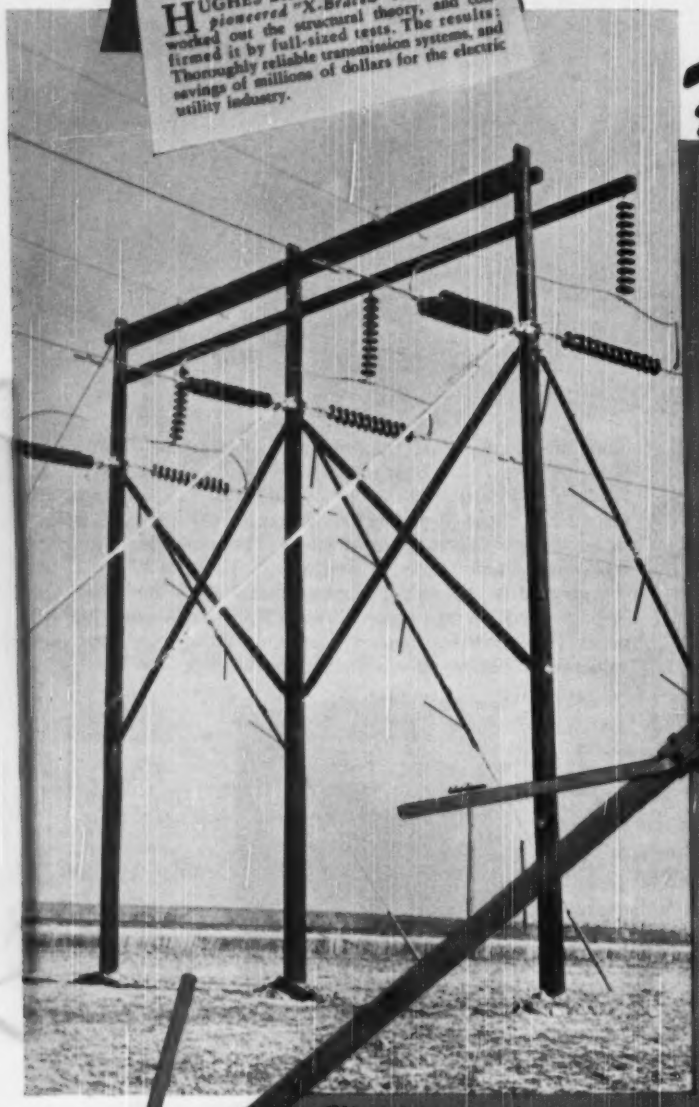
Above—25 KVA self-protecting, pole-mounted transformer. Right—Distribution transformer with cover-mounted high voltage bushings.

R. E. UPTEGRAFF

MFG. CO.

Scottdale, Penna.

HUGHES BROTHERS *developed and pioneered "X-Braced" construction, worked out the structural theory, and confirmed it by full-sized tests. The results: Thoroughly reliable transmission systems, and savings of millions of dollars for the electric utility industry.*



Hughes

WOOD STRAIN

GUY INSULATORS

maintain

IMPULSE INSULATION OF THE STRUCTURE

(Another Hughes development for better Transmission and Distribution Structures)

Hughes Wood Strain Guy Insulators are designed to serve a primary function, namely to maintain the impulse insulation value of the structure of which they are a part. The arcing horns are designed and spaced to give protection to the length of wood used in the insulator. The horns have a specific, predetermined spacing—an important factor which is not left to chance or field adjustment. The length of the insulator and clearance ratios are results of comprehensive electrical laboratory tests from which the gap is designed to fully protect the wood from damage due to flash-overs. Metal fittings, bolts and arcing horns are hot dip galvanized. Wood sections are Washington fir, especially selected for quality and straight grain, hot oil treated with pentachlorophenol. Hughes Wood Strain Guy Insulators are available with 15,000, 25,000, and 35,000 lbs. ultimate strength values. Special units are also available. Your inquiries are invited.

Manufacturers of

Transmission and Distribution Structures • Transmission Line Hardware • Prefabricated Wood Substations • Transformer Platforms • Wood Buyouts • Special Wood and Steel Items.

WHEN IT'S HUGHES
It's Tailored
TO YOUR NEEDS

HUGHES SEWARD
FOUNDED - 1921

HUGHES TRANSMISSION & DISTRIBUTION WOOD METAL MATERIAL MFRS.

BROTHERS NEBRASKA
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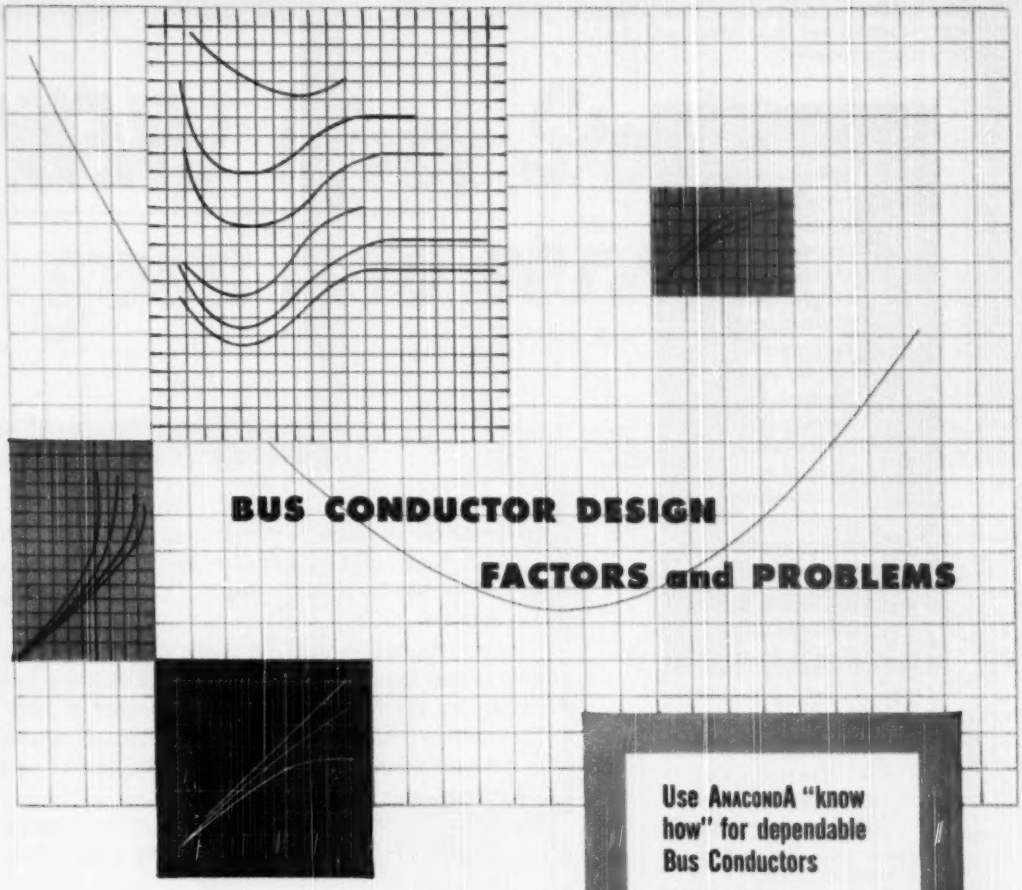


No. 1. Basic data for Bus Conductor selection

Performance curves, derived from data obtained by test of typical bus conductor arrangements presented in this book, can be interpolated to facilitate selection of a conductor arrangement best suited for an individual application. In many cases advantage is obtained by use of special conductors manufactured by Anaconda under our own patents. Our Technical Department is always available to engineers for consultation in selecting the most economical and effective types of Bus Conductors for specific requirements. The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

Use ANACONDA "know how" for dependable Bus Conductors

With the inception of electric power in the United States, Anaconda pioneered development of efficient bus conductors. Today ANACONDA *products, techniques and technicians are cooperating effectively throughout the entire field of power generation, distribution and application to provide bus equipment that will afford an optimum combination of capacity, security and economy for any specified job.*

Write for new edition of Publication C-25.

Carry the load with ANACONDA Bus Conductors

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD
JENNISON
CECIL LYNCH
HAVANA
MEREDOSIA
PERMIAN BASIN
O. H. HUTCHINGS
REX BROWN
HICKLING
B. C. COBB
RUSSELL
SEWAREN
POSSUM POINT
PORT JEFFERSON
CUTLER
WHITE RIVER
GADSDEN
POTOMAC RIVER
W. SPRINGFIELD

WOOD RIVER

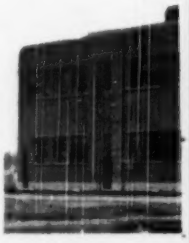
LAKE CATHERINE
DAN RIVER
ORAN
DUNKIRK
JIM HILL
TITUS
HUTCHINSON
BLACK DOG
DALLAS
NINEMILE POINT
EDGE MOOR
YATES
CONTRA COSTA
LEE
HAWTHORN
CLERMONT
MERAMEC
DANSKAMMER
LONG BEACH
PALATKA

NEW

All over the country new power stations are coming into being as the long range expansion program of the electric utility companies keeps out in front of the ever growing power demand.

A recent impressive example is the new Wood River Station of the Illinois Power Company which went into operation for the first time in late November of 1949. At that time two new 40,000/50,000 kw turbo-generator units were placed in service, and a third (duplicate) unit will be ready later this year.

This fine, modern power plant, located at the junction of the Wood and Mississippi Rivers near East Alton, serves the southern division of Illinois. It was engineered by Sargent & Lundy, Consulting Engineers, who also supervised the construction of the entire plant.



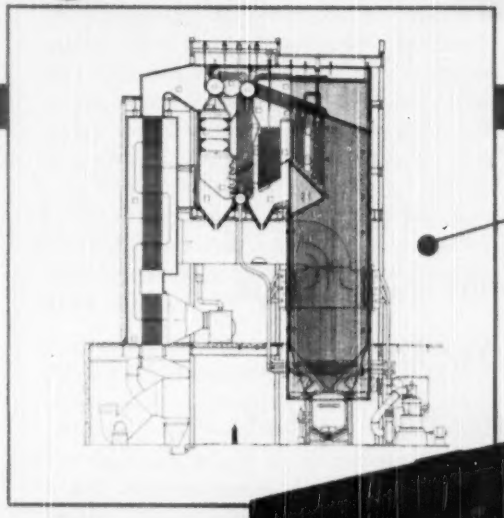
Steam for the two new turbine generators now in service, as well as for the third, presently under construction, is supplied by C-E Steam Generating Units. A sectional elevation of one of these three duplicate units together with a brief description is shown on the opposite page.

B-378

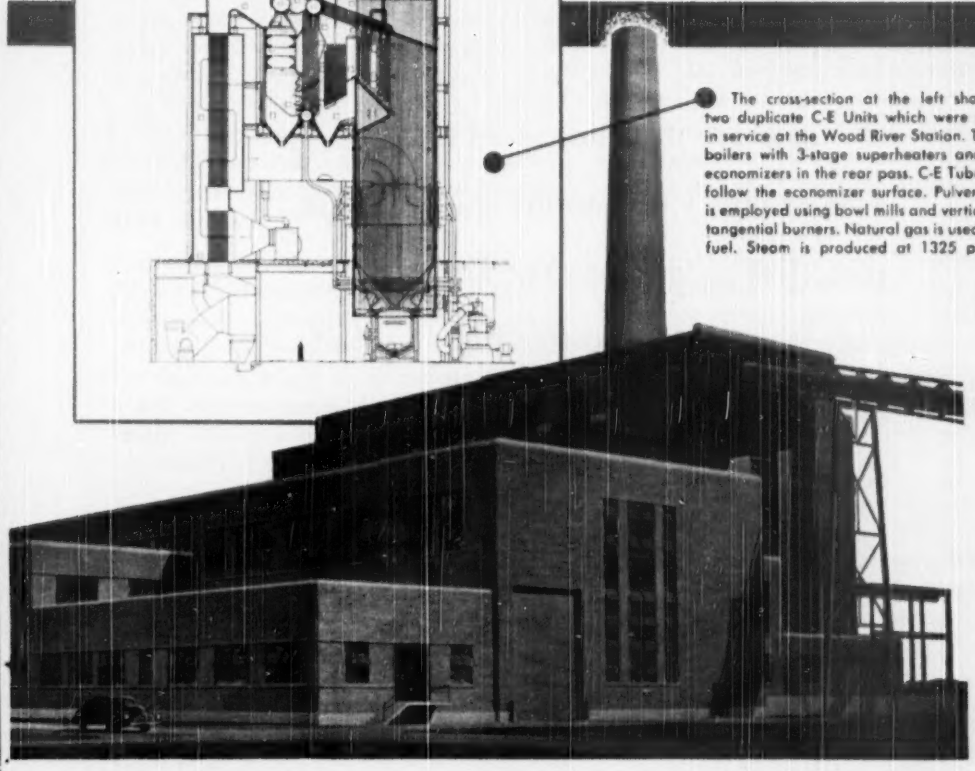
COMBUSTION ENGINEERING

A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY

Wood River Station goes into service



The cross-section at the left shows one of the two duplicate C-E Units which were recently placed in service at the Wood River Station. They are 3-drum boilers with 3-stage superheaters and have integral economizers in the rear pass. C-E Tubular Air Heaters follow the economizer surface. Pulverized coal firing is employed using bowl mills and vertically-adjustable, tangential burners. Natural gas is used as an auxiliary fuel. Steam is produced at 1325 psi and 1010 F.

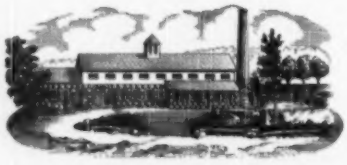


— SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

Time

Time is the measure of all things. Few of man's inventions can stand its merciless judgment. Yet Kerite for over 90 years has thrived and spread and gained renown. Time, indeed, gives Kerite its unqualified recommendation.



THE KERITE COMPANY

NEW YORK CHICAGO SAN FRANCISCO LOS ANGELES

Kerite Insulation—Your Cable's Best Life Insurance

Exploring Our Neighborhood

GRANTING THAT he's a fairly decent sort and you are too, it's pretty hard to work up a grouch against somebody you know. But if you don't know him, and although there is no malice in you, you can flame into high indignation against a man when a third person starts and fuels a fire in your mind with words intended to harm him. That's because you are a human being and therefore are more interested in what is wrong than in what is right. And in the English language there are a lot fewer words associated with virtue than with the lack of it.

All this is old stuff. Newspapermen and politicians know it instinctively; business men have to learn it. As a whole they started their lesson pretty late, and too many are slow to learn it. But some have learned it well and are applying it with excellent results. Take a look at the Industrial Information Institute, Inc. This is an organization of over 100 commercial and industrial firms in four counties around Youngstown, Ohio.

The purpose of the organization is to make clear to the public, employees, and businessmen of the area that their prosperity depends upon the continuous production of goods and services wanted all over the world, that there are good job opportunities right at home; to correct misconceptions with respect to industrial ownership and profits; and to present basic economic facts in such a way that everyone can understand them.

High ideals and plans do not make a successful program when it comes to dealing with people. But in the case of the "Industrial Information Institute", results are in ample evidence. Already there have been many plant visits arranged for teachers and clergymen. Four supplementary school books have been completed, and more are to come. They provide material for all school ages on the history and geography of the area along with the civic and economic activities affecting the children's. Two movies have been produced at an astonishingly low cost. Their character is clear from the titles: "Our Valleys are Green" and "The Right Road".

Other important programs include the annual Industrial Exposition, intended to show the young people and their parents what the valleys offer in the way of jobs and careers; distribution of material such as the comic booklet, "You Hit The Jackpot;" panel discussion meetings; promotion of simplified financial statements; and regular discussion meetings of employee publication editors.

The committees that carry out the activities come from those who are trained to do the job. School teachers prepare the text books, a public relations firm the films, and public relations executives of the plants coordinate industry's participation. Experts on each phase of the program assure its success.

History will record the success in this area, and one may be sure that it will also note the failures in other areas not following a similar pattern. We will be watching for sparks from progressive utilities setting the local fire needed to generate many more "Industrial Information Institutes."

Liberty Is Still Secure

THE NATION IS still safe. One of our basic American institutions persists—the Saturday night bath. Remember the wash tub on the floor beside the kitchen stove on which tea kettle and dishpan simmered to help out the reservoir at the side? Maybe that's going too far back for most of our readers. But probably many can recall when the idea of the daily bath first came into their lives. They were brought up in the Saturday night tradition even though never acquainted with other than the regular bath tub.

The wash tub and kitchen stove have been replaced almost universally by plumbing and the water heater. It is from evidence supplied by the water heater that proof of survival of the Saturday night bath comes. The evidence is contained in the article, "Controlled Water Heating Causes Off-Peak Peak", in this issue of ELECTRICAL WORLD. The "off-peak" peak on the system concerned came about midnight Saturday, indicating large use of hot water earlier in the evening. So long as the sturdy yeomanry, and probably many of the solid burghers, too, continue to soap themselves well on Saturday night to be clean for Sunday, we can be sure that the Palladium of our liberties is secure.

Industrial Power Sales Engineer

THE BEST DESCRIPTION of the functions and responsibility of an industrial power sales engineer we have ever heard came from D. B. Hyer, Jr, director of industrial development department, Florida Power Corp, in his talk at the Industrial Power Sales Conference of the Southeastern Electric Exchange at Atlanta.

Hyer first quoted "Slim" Cuyler (Louisiana Power & Light Co.) as saying that "your industrial sales engineer must be an expert driver, talker, liar, dancer, traveler, bridge player, poker player, toreador, golf player, diplomat, financier, capitalist, philanthropist, nudist; an authority on palmistry, archeology, psychiatry, philosophy, meteorology, criminology, dogs, cats, horses, trailers, blondes, redheads, lingerie and non-fattening candy for the customer's secretary."

He continued by referring to Ed Clapp's (Georgia Power Co) well chosen words: "The real power sales engineer uses tools he has accumulated over a long period of time, forged and tempered with years of experience, and kept sharp by continuing to add new ideas and discarding others. Just an ordinary power sales engineer rocks along with whatever tools he happens to find handy, never does much, never amounts to much, and is always wondering why he never gets anywhere."

Hyer went on to say:

"However, one thing stood out quite clearly in every case and that was that the real, chief responsibility and function of an industrial power salesman was to peddle all the kwhr he possibly could, to every industrial user he had on the system, while at the same time keeping a wary eye open for competition. In almost every case, he also had to be equipped to extol the virtues of Free Enterprise to anybody who would listen to him, while at the same time he was obviously trying to starve to death the manufacturers and sales representatives of any other free enterprise outfit which made a piece of equipment that could in any way be considered competitive to the sale of the aforesaid kwhr.

"That was just about it, with one other exception. He had to be able to walk into the office of any big industrial executive dressed in the height of fashion with a flower in his buttonhole and discuss in muted tones the nuances of intricate electrical devices. At the same time he must apparently be able to rip the ——— thing off, peel off his coat, roll up his shirt sleeves, sit down with a broken-down cotton gin operator and, while spitting tobacco juice 15 ft against a ten-mile headwind, try to collect a two-months-old power bill."

In this issue there is an article describing the functions and responsibilities of the "Ideal" Industrial Power Sales Engineer. It is a composite picture gathered from replies to a questionnaire sent by Mr Hyer to SEE member companies. In both that article and this editorial we are not attempting to exalt unduly the industrial power sales engineer. We do wish to emphasize the fact that this man is the key to the electrical industry's promotion of industrial progress. As such he should be given all the training and management backing that is warranted by such an important activity. And if profits are important, he warrants much.

Samuel Ferguson

TO SAMUEL FERGUSON, whose passing was recorded in last week's issue, the utility industry owes much. His was a rare combination of electrical engineer and economist. Selected many years ago to guide the Hartford Electric Light Co in pathways of progress initiated by its open-minded founder, Austin C. Dunham, Ferguson's influence soon pervaded the power company field and was respected to the last. His leadership at home was inspiring and enterprising. In naval terms his utility has been a "happy ship."

In national councils his inbred opposition to every sort of waste, whether by business or by government, was proverbial. Hospitality toward new engineering, commercial, employee and public relations developments pointing to improved operation, larger service and better customer understanding never failed to receive his executive encouragement. His courage in committing Hartford to the pioneer use of the mercury turbine and his acuteness in seeking the financial benefits of such an interconnection as the Connecticut Valley Power Exchange will long be remembered. To such leadership the industry may well give its accolade as it builds for future service on the superstructure envisioned by its departed men of achievement.

The Electrical Week

The Hydro-Electric Power Commission of Ontario is converting the southern part of the province from 25 to 60 cycles. It is the biggest job of its kind in history. Cost will be $191 million, time ten years (p 66) . . . The first test of strength between the new IUE-CIO and the UE-ex-CIO will come Feb. 28 in elections to be held at five electrical plants of General Motors Corp (p 68) . . . In 90 days consumers power districts may be formed in South Dakota under an act just passed at a special session of the Legislature. The aim is to get Missouri Basin power (p 69) . . . At Philadelphia the special System Planning Committee of the Pennsylvania Electric Association held its first meeting. The main topic was the choice of size of generating unit to obtain optimum economy and reserve provisions (p 71) . . . And General Public Utilities Corp has gone counter to the trend in annual reports. Its 1949 report is a simple, and economical, presentation of the holding company's activities. Pres A. F. Tegen believes that the average stockholder wants no more (p 72).

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Office of Energy and Utilities of the National Securities and Resources Board is putting the finishing touches on its third national electric survey. It will be completed within a few weeks.

David Lilienthal, former AEC chairman, has announced that he will: lecture—first appearance at Town Hall, New York City, March 1; write; and disclose more permanent plans next month.

Though very few power plants use anthracite coal for fuel, these plants had a stockpile of 4,259,533 tons on Jan. 1. Stocks of the much-more-popular bituminous totaled only 17,794,281 tons.

Sales by electrical goods wholesalers last year were off 9% from 1948, figures compiled by the Bureau of Census indicate. December sales were up only 5% from November and were 17% under December, 1948. Appliance and specialty wholesalers, however, reported sales in December, 1949 were 8% above those for the corresponding month of 1948.

Open frankness is so rare in propaganda out of Washington these days that you sort of admire a direct approach, however you may feel about the point of view being pushed. Case in point is a letter which an outfit called the People's Lobby, Inc, has sent to Congressional leaders. It asks for a new joint Congressional Committee "to study what industries should be taken over by the Government."

Latest round in the Kings River, Calif., power development battle at FPC: rehearing on a rehearing. Pacific Gas & Electric has filed a request for a rehearing on the commission's order granting a rehearing as asked by the Secretary of the Interior. The rehearing granted at Interior's request is still scheduled for March 20.

Thanks to John L.'s boys, electric utility coal consumption last December was 15.1% less than in the corresponding month of 1948. But fuel oil consumption was highest of record, 7,938,496 bbl, up 83.2%.

The Puerto Rico Water Resources Board had over 130 inquiries concerning its floating power plant but only one bid. The Brazilian Traction, Light & Power Co has offered $3.5 million. If the United States consents, the plant will go to Rio de Janeiro.

The Bell Telephone Laboratories have developed a super-coaxial cable which will simultaneously carry 1,800 long distance conversations or six different television programs.

Force account work, performed by the Bureau of Reclamation with its own forces instead of through contracts, amounted to only $5,741,000 or 2.6% in fiscal 1949. It was the smallest percentage of force account work in seven years.

National Bureau of Standards has established a new radio propagation field station at Fort Belvoir, Va., to assist in gathering data for shortwave broadcasting forecasts and warnings of sudden radio disturbances.

Notes From The News

More than 178,000 persons visited 15 major dams of the Tennessee Valley Authority in January. This was 42,234 more than in January, 1949. Chickamauga Dam was the most popular . . . Ontario Hydro-Electric Power Commission will name its new Toronto steam plant for Richard L. Hearn, its chief engineer . . . Employment in the electrical machinery field in Illinois fell off 16,000 workers in 1949 . . . Los Angeles (Calif.) County now has one television set for every 3.5 persons.

MAP shows the order in which Ontario Hydro proposes to convert various areas from 25 to 60 cycles. Dates are provisional

Ontario Saying Good-Bye to 25 Cycles

Hydro Power Commission Has 10-Year Program Underway to Convert System to 60 Cycles; Canadian Comstock Co Doing Work; Cost to Be $191 Million

(McGraw-Hill World News)

THE CONTINENT'S largest 25-cycle service area is going 60 cycle. In the southern part of Canada's Province of Ontario over 2,000 men have been at work since last October. They hope to be finished by New Year's Day, 1960. The job will cost over $191 million. The Hydro-Electric Power Commission, which is paying most of the bill, believes it is getting a bargain. And it has some good reasons.

While these reasons were thought out largely in terms of better customer service, other factors such as more readily adaptable interconnections, lower operating costs, and the important fields of research and defense played a major part in the final decision to embark upon the project.

Actual reasons for the conversion could be listed as follows: (a) flickerless lights; (b) lower cost of new 60-cycle equipment; (c) wider selectivity range of appliances; (d) complete interconnection of all 60-cycle areas in Ontario, the surrounding parts of Canada, and the United States, which will in time minimize the possibility of local power shortages; (e) possibility of exporting surplus power beyond provincial boundaries; and (f) interchange of frequency sensitive equipment.

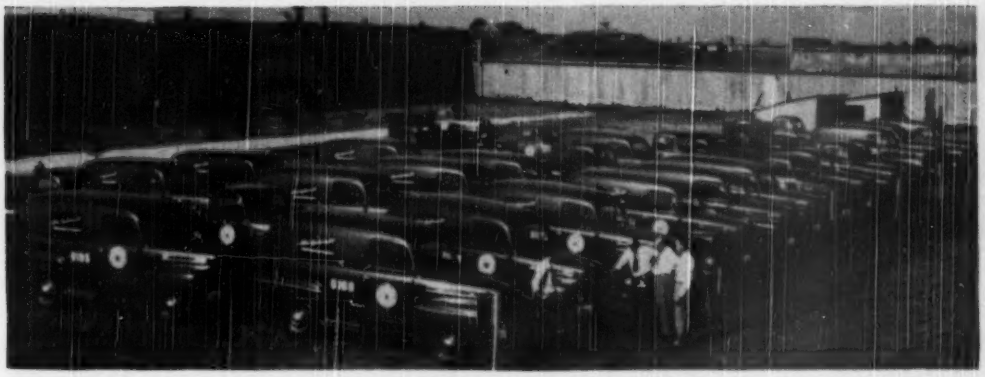
In the background is the possibility that the St. Lawrence power project might be underway or completed by the time the conversion job is, and interconnection is a "must."

The proposal to convert the area to 60 cycles is not a particularly new one. The idea had been talked over for years. With the difficulties of operating the 25-cycle system increasing each year, Ontario Hydro decided to act. In 1946 it issued the first report outlining the proposed project. It was based on an engineering study by Stone & Webster Engineering Corp and a financial one by Clarkson-Gordon & Co, Toronto. These in turn were reviewed by Harold Hobson, British engineering consultant. By 1948 Ontario Hydro was ready to go ahead with the conversion project.

The job was given to Canadian Comstock Co, Ltd. The president of the firm, Charles C. Rathgeb, turned to two Americans to head the project. C. R. Holl was made project manager and Tom Shook as his assistant is conversion superintendent. Both men had been employed on the Southern California Edison Co 50-60-cycle conversion job.

These men got together with Harry

INTERIOR of mobile workshop used by Canadian Comstock to convert small motors



PART OF TRUCK FLEET used by Canadian Comstock on Ontario conversion job. Trucks haul appliances between homes and shops

H. Leeming, director of Hydro's Frequency Conversion Division, and laid out the many detailed steps of the entire program. These included the time schedule of the conversion by areas. And while the technical procedure was well understood, the problem of human relations had to be studied thoroughly in order to keep the customers happy.

Hydro engineers visit the area well in advance of the actual working date and, with the assistance of the municipal commissions, record and map feeder lines, substations, transformers, and other physical facilities. Then two months before conversion Canadian Comstock's men inventory the premises of all consumers. They get the data on all frequency-sensitive equipment. On the basis of this inventory purchases of replacement materials and parts are made.

It is estimated that some 1,800,000 units will be involved. Included are motors for 550,000 washers, 300,000 refrigerators, 400,000 clocks, 100,000 furnaces blowers, and 167,000 industrial and 175,000 commercial motors. These will total over 980 types, makes, and sizes, as well as a variety of special equipment. In certain appliances gears and complete units have to be adapted for 60 cycles. About 800,000 customers will be affected.

Several days before the conversion the customer is notified and asked to remain at home. A crew of five to seven men comes into the home. Each man is a specialist. Some appliances and the meter are changed or converted in the home. Others are removed to mobile repair shops. If necessary a 60-cycle appliance is loaned to the householder until his appliance can be returned. No converted appliance can be used until power is restored at 60 cycles, usually two to three hours later.

The work takes so little time because of the arrangements made before. At St. Catharines, on the Niagara peninsula, Comstock has set up a 130,000-sq-ft plant as conversion headquarters. Here are key administrative and supervisory staff members. Assistants direct numerous subdivisions, which handle industrial consumers, domestic elevators, fluorescent lighting, etc. The area setup includes a production factory, a number of mobile shops, and a fleet of 300 trucks. This setup will move from area to area as required.

Hydro also has set up a factory-like conversion center at Islington. This 241,000-sq ft plant will handle bulk materials, salvage, rewinding, and meter conversion.

The electrical dealer is not a forgotten man. He is advised a year ahead and advised to go easy about stocking 25-cycle equipment. Later he is visited by a Hydro representative who explains to him how he can arrange with his supplier or manufacturer to exchange leftover 25 for 60-cycle equipment.

The ordinary residential consumer is a big gainer by the conversion. He pays nothing directly, and much of his equipment is put in first class shape. Of the $191 million required some $20.5 million will be put up by the municipal systems for their own conversion. Large industrial users will provide about $18 million. They will be required to contribute on the basis of the number and ratings of their motors actually rewound or replaced.

Ontario Hydro will put up the remainder of the money. It has $87 million in reserve. It will get the other funds needed from operating surplus each year and from sale of surplus power as a result of the conversion.

And it's Hydro's Frequency Conversion Division that will pay in headaches for the entire job. This 650-man staff does the initial survey work, purchases replacement parts, handles complaints, investigations, and complaints. Separate area offices have been set up to handle this work. But all have the same instructions: "Keep the customer happy."

HARRY H. LEEMING

CHARLES C. RATHGEB

LIVING-DINING ROOM is one of a series of five rooms set up by the Chicago Lighting Institute, 37 S. Wabash Avenue. The rooms are arranged to be used as a laboratory to demonstrate the appearance of carpeting, draperies, paint and wallpaper, furniture, and accessories under incandescent or fluorescent lighting or both

Elections at 5 GM Electrical Plants Will Test Strength of IUE-CIO

By Joseph Gambatese

Five General Motors Corp electrical plants will provide the first major test this week of strength of the new CIO International Union of Electrical, Radio & Machine Workers in the electrical industry.

Some 27,500 employees will vote to join the IUE-CIO, the rival United Electrical, Radio & Machine Workers (ex-CIO), or neither. Elections will be conducted Feb 28 by the National Labor Relations Board at these GM plants—Frigidaire and Delco Products in Dayton; Packard Electric, Warren, Ohio; Delco-Remy, New Brunswick, N. J.; and Delco Appliance, Rochester.

Anything less than a clean sweep of all five plants will amount to a setback for the new CIO union, organized after UE was expelled from CIO last November. For it is in GM that the right-wing of CIO is supposed to be strongest.

Any sign of CIO weakness in GM will certainly be exploited by the left-wing UE in bigger elections later at General Electric (125,000 employees) and Westinghouse (75,000 employees). Likewise, a resounding victory will be used to advantage by the IUE-CIO.

The union in control of bargaining in these three companies eventually will speak for the whole industry. Other plants will naturally gravitate to its banner. During the transitional period, however, the industry—and many companies—will likely have two unions on its hands.

That is almost certain to happen in GE and Westinghouse. Neither union will sweep all their plants. So the second round between the two unions will come when they sit down to negotiate contracts after NLRB elections. Each will try to out-demand the other and win better terms.

The two-union setup may have this advantage over the present single-union bargaining structure:

Each union will be more reluctant to strike. If one union does strike, the company's production will continue at plants whose employees are represented by the other union. So impact of the strike will be softened.

That's what happened last year in the CIO Steel Workers' strike against the Aluminum Co of America. Alcoa production continued uninterrupted at AFL organized plants.

The IUE-CIO claims to have won 10 and lost 3 small NLRB elections up to the end of January. It also claims that local unions representing 255,000 employees have affiliated, although IUE has not yet established itself as their bargaining agent.

UE, on the other hand, contends it has not suffered much loss of membership. The IUE-CIO has taken away only 60,000 of its members, UE claims, and this has been offset by the addition of 40,000 members of the left-wing Farm Equipment Workers and 12,500 new members.

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2 REA Engineers Get Promotions to New Posts

Rural Electrification Administration has promoted two of its regional construction engineers to newly created positions.

Raymond W. Lynn, regional construction engineer for the Arkansas-Louisiana-Oklahoma area, becomes assistant chief for telephone design and construction of REA's engineering division. Lynn will head REA engineering work in the telephone field, which the agency is now entering.

A new technical operations and maintenance section of the engineering division for REA's electrical program will be headed by Chris L. Schultz, who has been Region 1 construction engineer for Illinois, Iowa and Wisconsin.

Duties of the new section will include maintaining information on the most advanced technical operating and maintenance practices and developing REA recommendations and requirements.

Hoburg B. Lee, assistant regional engineer in the Southeast, will succeed Schultz as regional construction engineer, while John H. Rixse, Jr., assistant regional engineer in the West, will move into the position vacated by Lynn's promotion.

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To Build Michigan Plant

Consumers Power Co, Jackson, Mich., will build a power plant on Lake Erie, just north of the Ohio line. The plant is to have two 85,000-kw units. The first is to be ready for operation in 1952. A third 60,000-kw unit is also to be added at the B. C. Cobb Plant, Muskegon.

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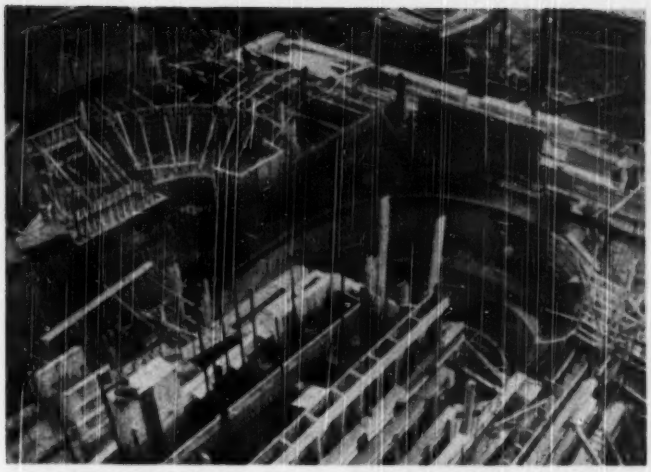
Utility to Add 2 Diesels

Bangor (Maine) Hydro-Electric Co will install two 1,000-kw diesel units at Eastport and East Machias, bringing the total diesel capacity of the company to 6,000 kw. A 6,000-kw gas turbo-generator at Veazie goes into service next fall.



VERMONT-NEW HAMPSHIRE boundary falls between these two generating unit scroll cases at New England Electric System's Wilder development. Here 33,000 kw will replace 5,000 kw formerly available at this Connecticut River site. Plant will be interconnected

South Dakota Authorizes Consumers Power Districts; Voters Must OK

A SPECIAL SESSION of the South Dakota Legislature has passed an act authorizing formation of consumers power districts. The act will take effect in 90 days.

Districts may be created in any governmental subdivision or combination of them by a 5% petition which initiates an election. If a majority of the electors vote for a district, the circuit judge who received the petition orders the district formed. Districts may be enlarged by an election in the area to be added.

Initially the directors of a district will be named in the petition. Thereafter, directors will be elected on nonpartisan ballots. The number of directors may vary from 5 to 21.

The act provides that a district may build transmission lines, generating plants, and other facilities within and beyond its boundaries. It may wholesale power anywhere but is restricted to retailing power within 12 miles of its boundaries, provided such area does not have existnig central station service.

The act provides that directors may negotiate bonds for the "advantage, benefit, and best interest of the district." An attempt to amend the bill to provide for public sale of bonds or negotiation up to $25,000 in bonds and public sale thereafter was defeated.

Employees have the same collective bargaining powers and other rights enjoyed by employees of private enterprise. Any salaries in excess of $10,000 a year must be published annually.

The district is a public body like any subdivision of government. Its boundaries conform to those of municipalities, townships, counties, or combinations of them. Elections may be general or special but may not be held more than once a year on the formation of a district.

The districts will have no power of taxation. They are limited to liquidating their indebtedness out of revenues. They must advertise for bids on projects costing more than $1,000, but directors have power to cope with emergency situations.

The districts will pay all state and local taxes now paid by private utilities. The language of the act says:

"There is hereby levied upon . . . each district an occupational excise tax equal to all the taxes, including . . . licenses, excise, property and special assessment taxes, except federal taxes, which a person, partnership, association or private corporation engaged in a similar business would be required to pay."

The act as passed by the Legislature and signed by the governor was substantially in the form recommended by a fact-finding committee appointed by the governor. Previously, the fact-finding committee had recommended that districts be established by "majority vote of the electors within the included area." Opponents of public power conceded that only negotiation of bonds would enable a district to get money with which to start. Public power advocates lost their fight for unlimited retailing or authority for districts to do business anywhere.

Minor amendments provide that districts can not engage in the electrical appliance business and that property of a defunct or liquidated business can be sold to private individuals or corporations after the electors approve such action by the directors.

There was no indication when the first power district would be formed. Gov George T. Mickelson has said that the two main benefits South Dakota will derive from the Pick-Sloan plan for development of the Missouri River basin are irrigation and power. He saw urgency—in view of Bureau of Reclamation planning for power grid systems—for enabling legislation to help the state get its fair share of power.

The governor termed the bill workable and fair. Many opponents of public power, who feared that a district started in a small subdivision could swallow the state, felt the provision for a majority vote left this question to the voters.

Rural electric associations, Farmers Union, and other public power proponents criticized the act as unworkable because of its restriction on retailing within a district. They sought to form districts by the petition method instead of the ballot.

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4 Maps Showing Electric Facilities Issued by FPC

The Federal Power Commission has published four maps showing electric facilities. One, "Principal Electric Facilities in the United States," is 44 x 64 in. on a scale of 60 miles to the inch. The map shows most generating stations of 1,000 kw or more and transmission lines 33 kv and up. The map is based on reports filled by utilities through mid-1948. Selling price is $6.

The other three maps show electric facilities in Arizona, Colorado, and Wyoming. These are 21 x 28 in. on a scale of 20 miles to the inch. They sell for $1 each.

All of the maps can be ordered from the Publications Section, Federal Power Commission, Washington 25, D. C.

LOWER COLORADO RIVER AUTHORITY has moved into its new headquarters on the outskirts of Austin, Tex. A heat pump installation is used for both heating and air conditioning

Transformer Noise Intrudes Again, This Time into EEI Group Papers

TRANSFORMER NOISE intruded into the paper presentations on other topics at the meeting of the Edison Electric Institute Electrical Equipment Committee at Cincinnati Feb 13 and 14. Concensus was that the problem is accentuating, that something must be done about it, and that the manufacturers are actively studying the correctives. Utilities are hoping to build noise barriers.

C. T. Hughes, Connecticut Light & Power Co, said it was smart to install the barriers before the units are energized because the neighbors remain critical once they have sensed the hum. Doubt was cast by him and A. M. deBellis, Consolidated Edison Co of New York, on the adequacy of the decibel index for disturbances that seem to be transmitted by vibration as well as airborne noise.

The issue was first injected after E. A. Church had added the Boston Edison system evolution to the continuing series of system plan papers. The company's 517-Mw peak was met with a layout embracing a 110-kv ring, several 66-kv and 24-kv ties, numerous 13.8-kv feeder loops, three primary networks and 15 dc substations, still serving about 66 Mw of city load.

Sunbury Station plan of lighting was outlined by W. B. Morton, Pennsylvania Power & Light Co. Intensities achieved by proper units properly placed in properly tiled or painted rooms were given in the following footcandle values: control room, horizontal 120, vertical 45; shops, general 50, work benches 125; laboratories 25; turbine room and offices 50; general inside areas 25. Slotting of fluorescent fixtures averted the "cavern effect" of brightness difference between the tubes and the otherwise dark ceiling areas. Plastic louvering of the control room, he said, gives less eggcrate pattern on the instrument glasses than metal louvers.

Survey by L. Birckhead, Consolidated of Baltimore, of 222 units totalling 9,000,000 kw showed 73% taking auxiliary supply from transformers connected on the alternate leads with 18% off the station lines; for emergency backup 63% relief on the station bus and 21% on the connected system.

Induced potentials during fault conditions were found on the Cincinnati system to result from coupling of paralleled circuits to such extent as to necessitate a modified form of directional comparison carrier pilot relaying using Mho phase relays and unconventionally connected ground relays. W. T. Pavely and S. Goldsmith detailed the wide unbalance in zero phase sequence currents and the polarized technique devised to circumvent it.

Flux testing of large machine armatures is proving efficacious in disclosing defects in lamination assemblies, according to Harris Barber of New England Power Service. Mica wedges are feasible remedies to hold core temperatures down and retain capacity.

Switchgear manufacturers are to be asked to participate for discussion of solenoid voltage ratings.

Public Apathy Blamed on Lack of Knowledge

The general public is apathetic toward government-controlled power because the power companies haven't shown their customers where their self-interests lie. This was re-emphasized by E. W. Smith, Pennsylvania Power & Light Co, at the joint winter meeting of the Transmission and Distribution and Accident Prevention Committees of the Pennsylvania Electric Association at Harrisburg, Feb 16-17.

Illustrating how the public isn't aware of the situation, Smith pointed out that in 1948 the 17 Northeastern states paid 65% of the total federal income tax (and therefore contributed 65% to the cost of all federal power projects) but benefited from only 20% of the total money spent on such projects. Commenting on the effects of Socialism, he remarked that whenever government enters an area formerly served by private enterprise, it increases the tax burden two ways. First, it removes a possible source of revenue; second, it adds another possible area of federal spending.

Speaking on the chemical control rights-of-way, R. R. Fouracre, E. I. DuPont de Nemours Co, cautioned that use of herbicides which kill only certain plants will accentuate the growth of other unaffected species. R. R. Wangerin, Monsanto Chemical Co, received agreement of the committee on the use of oil as a carrier for dormant and stump spraying and water for foliage treatment.

Future objectives in chemical control of right-of-way, presented by Fouracre, Wangerin, and H. L. Smith, Dow Chemical Co, included: (1) The possibility of year-round control by means of basal spraying during the dormant season; (2) more and better information on the effects and relative merits of herbicides; (3) low-volability sprays to decrease the problem of drift; and (4) simplification of the use of sprays by better identification of containers, by development of oil and water soluble formulations, and by elimination of additives.

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Pay Increases But—

Electrical workers employed by the City of Anchorage, Alaska, have won wage increases of 13% but gave up paid holidays, sick leave, vacations, and the guaranteed 40-hour week in return. Linemen receive $3 an hour under the new contract, as compared to the previous rate of $2.65, while other wage classes receive proportionate increases.

PEA System Planning Committee Holds First Meeting at Philadelphia

CHOICE OF SIZE of generating unit to obtain optimum economy and reserve provisions was the theme at the initial meeting of the special System Planning Committee instituted by the Pennsylvania Electric Association. The Philadelphia sessions on Feb 16 and 17 incidentally brought out some of the limitations of the unit plant designs insofar as they tend to necessitate increased margins of reserve somewhat offsetting the capital and operating economies afforded.

Think Big, Act Big

Loads have invariably been estimated too low, and "we must think big and act big," said M. D. Engle, Pennsylvania Power & Light Co. in presenting the station designer's attitude on unit size. He favored 15 to 20% increments because 10% addition would constitute only 5% after a 10-year doubling and be down to 2½% after 20 years. Engle deemed it uneconomical to operate a multiplicity of units each representing only 1 to 2% of aggregate system megawatts. In discussion Chairman W. J. Lyman, Duquesne Light Co, pointed out that the incremental capacity of large units can sometimes be obtained at half the cost of the base capacity.

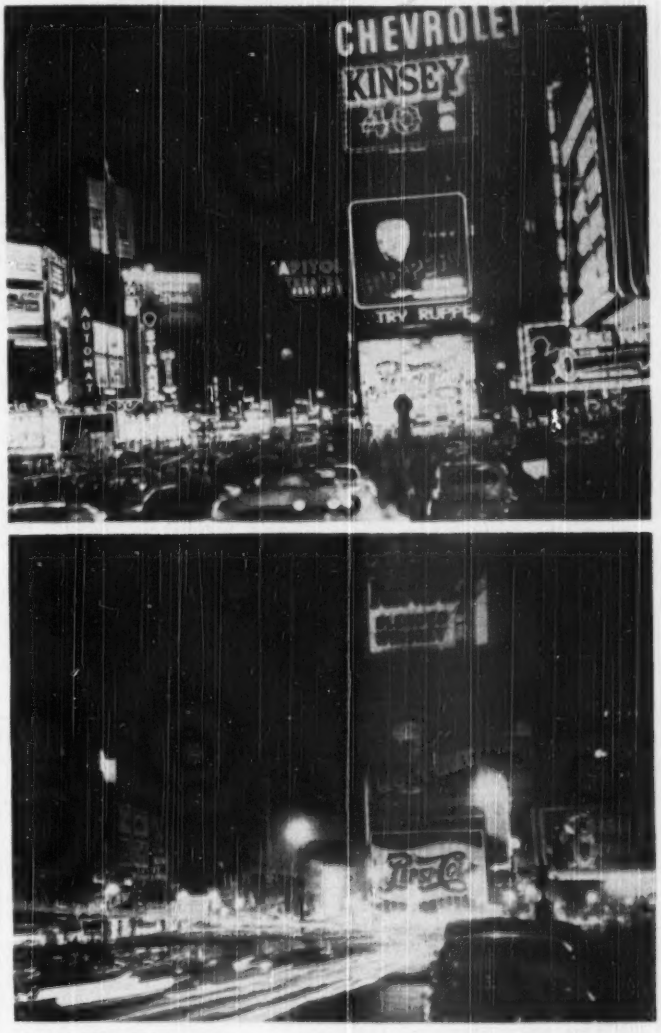
The station operator's viewpoint, presented by W. V. Drake, West Penn Power Co, embraced six factors: simplicity of operation, large boilers, the unit plant trend, effect of size on station efficiency, and maintenance. Small units are selfishly desired because they give wider latitude in scheduling interconnection operation. Drake believed it wrong not to provide spare pulverizers and other critical auxiliaries.

Large Units Favored

Operating performance costs and appropriate steam conditions for the various types and sizes of turbogenerators were explained by J. B. McClure for General Electric and J. R. Carlson for Westinghouse. McClure said that neither reliability nor maintenance is considered to be influenced by size or type or even the inclusion of reheat. Carlson pointed out why costs and operating efficiencies dictate purchase of the largest justifiable units. He confirmed Engle in asserting that rapid load growth justifies larger units than mere equality with the immediately prospective load increment.

From the system operator's viewpoint the size of units chosen should be based on the reserve requirements of the system, according to W. C. Bryson, Duquesne Light. The unit-type station may require more installed capacity than would be demanded if boilers were cross-connected. This was confirmed by H. W. Phillips, Penn-N. J. Interconnection, in a probability compilation which showed the ratio of one-day forced outages with the unit-type plant versus those with "infinite" boiler capacity to be 4/1 for double outages, 8/1 for triple, and 15/1 for quadruple. The economy of unit stations may thus be offset by added cost of reserves.

In a luncheon talk R. G. Rincliffe of Philadelphia Electric said that an 8,500,000 kw load had been phophesied for his system in the year 2000 but all this was contingent upon preserving American freedom to function so as to keep abreast and ahead of requirements.



NEW YORK CITY shows effect of coal strike as governor orders a brownout. Times Square is shown before and after the brownout went into effect. Broadway is at top left and Seventh Avenue at top right in both pictures. Outside lighting is limited to 200 w

FINANCIAL

GPU 1949 Annual Report Counters Current Trend Toward Lavishness

GENERAL PUBLIC UTILITIES CORP is charting a new course in annual reports to stockholders.

GPU's 1949 report, just issued, is on a tack radically different from the one that has predominated in recent years. The tendency, for utilities as well as for most manufacturers, has been toward more and more lavish annual reports. Companies have been going overboard on size, color, pictures, dressed-up graphs and tables (EW, April 23, 1949, p 71).

Reports Held Too Costly

A. F. Tegen, GPU president, thinks this trend has gone too far. He says stockholder response doesn't justify the time and money that have been going into annual reports.

His company's 1949 statement illustrates his new approach. It is a two-color folded mailing piece printed on both sides of uncoated offset stock. There are no illustrations of generating plants or employee banquets, no pie charts of income distribution or elaborate system maps. There is simply a text summary of what happened to the holding company during the year with a few greatly condensed tables covering the highlights of its current financial position.

Letter Summarizes Year

Body of the report is a four-page letter to stockholders, written in a simple, informal style with frequent use of "we" and "you." It summarizes such points as 1949 earnings and prospects for 1950; 1949 and 1950 construction and financing; current capitalization; rates; reduction of indebtedness; integration progress and sales of assets; relations with regulatory bodies; and status of GPU's Philippine subsidiaries. The report concludes with "important tax information."

No longer new to corporate management is the realization that different groups of stockholders require different types of financial information. Most companies have tried to solve this problem by placing condensed financial statements, from one to four pages long, in the front of their reports, with more complete figures in the back for the benefit of large investors and security analysts who want all the details.

GPU has gone a step further. Tegen says the little stockholder only wants to know whether or not his company "is doing well." Inside the GPU report is the basic answer to this question: three large tables summarizing earnings and expense items for 1949, 1948, and 1947; 1949 balance sheet items; and consolidated income for last year. For the financially sophisticated, a statistical supplement will be mailed on request.

The report embodies ideas Tegen picked up talking to stockholders at meetings in various parts of the service areas of GPU subsidiaries. It is timely—its simplicity has made possible publication well ahead of most other annual reports. It is inexpensive—stockholders need have no fear management is squandering their money on elaborate promotion pieces. It is written in a style that demands no special knowledge or background from the reader. And its content is pared to the bone, reflecting one stockholder's complaint, "Pictures of generating plants are very pretty—but I'm no engineer. They all look alike to me."

RECENT RATE CHANGES

Pennsylvania Electric Co's proposed $34,580-a-year rate cut has been okayed by the Public Utility Commission. The new rates will affect 2,637 customers in the Cambria County territory taken over by Penelec in its purchase of Gallitzin Electric Light Co, Cresson Electric Light Co, and Hastings Electrical Co. However, rates for 96 other customers will be boosted a total of about $4,000 a year.

Orlando (Fla.) Utilities Commission has reduced electric rates from 10 to 18%, with the base rate lowered from $1.50 to $1. Residential consumers will save about $170,000 annually. No change was made in commercial rates.

FINANCIAL BRIEFS

Virginia Electric & Power Co has called for March 2 redemption its $4 million of 3⅛% convertible debentures due April 1, 1963. The conversion privilege ended Feb 20.

Westinghouse Electric Corp has raised its quarterly common stock dividend from 25 to 40¢ a share. The dividend is payable March 1 to stockholders of record Feb 7.

Virginia Electric & Power Co has received State Corporation Commission permission to issue an unspecified number of $10-par common shares and 100,000 shares of $100-par preferred.

South Carolina Public Service Authority has refunded $29,014,000 of bonds held by the United States government. The operation cut interest rates from 4% to 2.5% annually.

•

Utility Wins First Round in Fight for 8.6% Return

Citizens Utilities Co has won the first round in a legal battle that could have a major effect on utility rate-making theories.

In a case involving the company's Vermont electric division, the state court challenged the generally accepted standard of a 6% rate of return. Citizens Utilities had claimed it required an 8.6% return to carry on its business and attract the new capital required for construction. The court remanded the case to the Vermont Public Service Commission, saying the regulatory agency had offered no substantial proof to justify its choice of a 6% rate of return.

Yields — Operating Electric Utility Securities

Date of Period	Bonds			Preferred Stocks			Common Stocks		
	1st Quality	2nd Quality	3rd Quality	1st Quality	2nd Quality	3rd Quality	1st Quality	2nd Quality	3rd Quality
1950									
Feb. 16	2.56%	2.59%	2.70%	3.81%	4.01%	4.43%	5.24%	5.89%	6.54%
Feb. 9	2.57	2.59	2.70	3.82	4.02	4.43	5.22	5.88	6.54
1949									
Feb. 14	2.72	2.81	2.95	4.02	4.30	4.68	5.87	7.04	8.61
Feb. 7	2.72	2.81	2.95	4.00	4.27	4.69	5.82	7.04	8.50
AVERAGES FOR LAST FOUR QUARTERS									
4th 1949	2.59	2.61	2.72	3.85	4.06	4.46	5.37	6.15	7.01
3rd 1949	2.61	2.65	2.77	3.88	4.15	4.54	5.55	6.47	7.51
2nd 1949	2.69	2.75	2.88	3.98	4.26	4.66	5.94	6.96	8.14
1st 1949	2.70	2.78	2.92	4.00	4.27	4.67	5.78	6.69	8.08

Data: Reis & Chandler, Inc.

CURRENT YIELDS on securities of operating electric utilities are shown above, with comparative figures for the corresponding weeks a year ago and averages for the last four quarters. These indexes, a new service of ELECTRICAL WORLD, will appear weekly

Output Again Declining, Still Is Well Above 1949

Output again declined slightly in the week ended Feb 18 but held well above the corresponding week a year ago.

In the week of Feb 18 the nation's electric light and power companies distributed 5,931,351,000 kwhr, compared to 5,970,919,000 kwhr the week before. Last week's output, however, was 5.0% above the equivalent week of 1949, when figure was 5,650,279,000 kwhr.

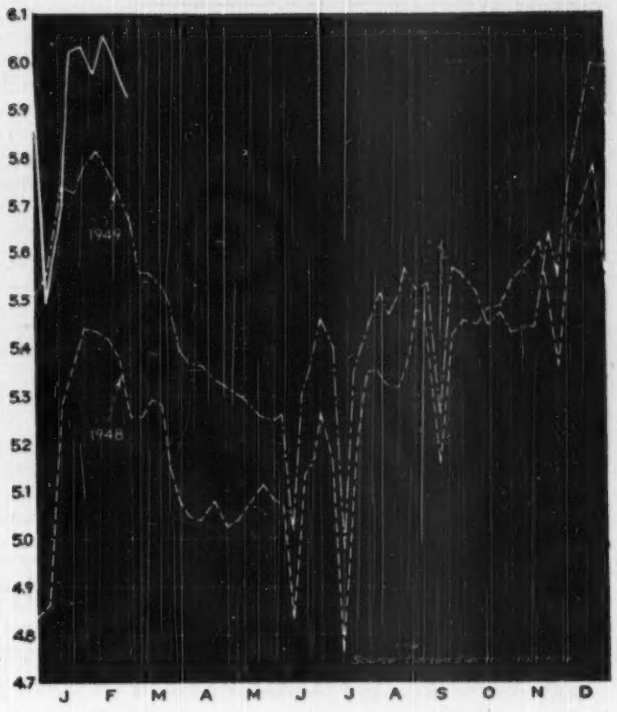
All regions of the United States remained in the plus column.

Weekly Output, Millions Kwhr

1950		1949		1948	
Feb. 18	5,931	Feb. 19	5,650	Feb. 21	5,254
Feb. 11	5,971	Feb. 12	5,722	Feb. 14	5,385
Feb. 4	6,062	Feb. 5	5,778	Feb. 7	5,412
Jan. 28	5,972	Jan. 29	5,810	Jan. 31	5,429
Jan. 21	6,041	Jan. 22	5,769	Jan. 24	5,436
Jan. 14	6,029	Jan. 15	5,727	Jan. 17	5,370
Jan. 7	5,695	Jan. 8	5,742	Jan. 10	5,278
1949		1949		1948	
Dec. 31	5,493	Jan. 1	5,562	Jan. 3	4,868
1949		1948		1947	
Dec. 24	5,994	Dec. 25	5,508	Dec. 27	4,826
Dec. 17	5,997	Dec. 18	5,790	Dec. 20	5,368

Percent Change from Previous Year

	Feb 18	Feb 11	Feb 4
New England	+10.2	+ 9.6	+ 7.9
Mid-Atlantic	+ 4.7	+ 3.3	+ 1.8
Central Industrial	+ 2.2	+ 1.2	+ 0.8
West Central	+ 6.6	+ 4.9	+ 6.3
Southeast	+ 6.9	+ 3.7	+ 5.6
South Central	+11.0	+12.2	+13.3
Rocky Mountain	+ 1.5	+ 2.3	+ 3.0
Pacific Coast	+ 4.5	+ 7.7	+11.8
Total United States	+ 5.0	+ 4.3	+ 4.9



MEETINGS

American Society for Testing Materials
Committee Week and Spring Meeting, Hotel William Penn, Pittsburgh, Pa., February, 27-March 3.

Pennsylvania Electric Association
Relay Committee, Spring Meeting, Benjamin Franklin Hotel, Philadelphia, Pa., March 2-3; Communications Committee, Spring Meeting, Lawrence Hotel, Erie, Pa., March 30-31; Transmission and Distribution Committee, Spring Meeting, Alexander Hotel, Hagerstown, Md., May 25-26, Joint Meeting, Traffic Safety Committee, May 26.

★ **North Central Electrical Association**
Annual Convention, St. Paul Hotel, St. Paul, Minn., March 5-9.

Interstate Power Club of New York
Hotel Martinique, New York, N. Y., March 6.

National Rural Electric Cooperative Association
Annual Convention, Hotel Stevens, Chicago, Ill., March 6-9.

National Electrical Manufacturers Association
Edgewater Beach Hotel, Chicago, Ill., March 13-16.

Industrial Electrical Show
Exposition of Commercial and Industrial Equipment sponsored by Electrical Maintenance Engineers Association of Southern California, Inc., Shrine Convention Hall, 700 West 32nd St., Los Angeles, Calif., March 15-18.

Edison Electric Institute
Industrial Relations Committee, EEI headquarters, New York, N. Y., March 16, Netherland-Plaza Hotel, Cincinnati, Ohio, April 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., April 4-6; Purchasing and Stores Committee, Schroeder Hotel, Milwaukee, Wis., April 24-26; Electrical Equipment Committee, Edgewater Beach Hotel, Chicago, Ill., May 2-3.

Conference for Protective Relay Engineers
Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, Tex., March 20-22.

Southeastern Electric Exchange
Engineering and Operating Section, Buena Vista Hotel, Biloxi, Miss., March 23-24; Annual Conference, Greenbrier Hotel, White Sulphur Springs, W. Va., April 12-14.

American Public Power Association
Annual Convention, Shoreham Hotel, Washington, D. C., March 28-30.

Missouri Valley Electric Association
Engineering Conference, President Hotel, Kansas City, Mo., March 29-31; Accounting Conference, President Hotel, Kansas City, Mo., May 18-19.

Midwest Power Conference
Sherman Hotel, Chicago, Ill., April 5-7.

★ **American Institute of Electrical Engineers**
Conference on Protective Welding, Hotel Detroit Leland, Detroit, Mich., April 5-7; Great Lakes District Meeting, Hotel Hayes, Jackson, Mich., May 11-12.

American Society of Mechanical Engineers
Spring Meeting, Hotel Statler, Washington, D. C., April 12-14.

Northwest Public Power Association
Semi-annual Convention, Davenport Hotel, Spokane, Wash., April 17-19.

American Institute of Electrical Engineers
Power Conference sponsored by Committee on Power Generation, Industrial Power Systems, and System Planning, William Penn Hotel, Pittsburgh, Pa., Power Generation, April 19, 11. Industrial Power System, April 20.

Electrochemical Society
Annual Convention, Statler Hotel, Cleveland, Ohio, April 19-22.

Oklahoma Utilities Association
Annual Convention, Biltmore Hotel, Oklahoma City, Okla., May 4-5.

★ **New Jersey Utilities Association**
Annual Spring Conference, Seaview Country Club, Absecon, N. J., May 12.

★ Addition This Week

NEW FEATURE

"INDUSTRIAL BRIEFS"

Containing short, snappy

"Off-the-shelf", new

LOADING BUILDING APPLICATIONS

See Page 120

Farm Booklet Ready

The National Adequate Wiring Bureau has ready for distribution an illustrated booklet on "Planned Wiring, The Key to Better Farming." The booklet explains the advantages of the use of electricity on farms and rural homes and supplies wiring diagrams for various farm installations. The NEMA Farm Electrification Bureau, 155 E 44th St, New York 17, N. Y., is distributing the booklets at a small charge. Unit price is lower on large quantities.

WASHINGTON COMMENT

RONALD D. ROSS

THE TENNESSEE VALLEY Authority probably will begin construction soon of another major steam generating plant, its second in less than 12 months. And it will do so with the acquiescence, if not the complete approval, of the privately owned electric utility industry.

This is in sharp contrast to the situation a year ago when TVA had to battle the industry every step of the way toward authorization of its New Johnsonville steam plant. But a clear-cut issue of simple federal power expansion lay at the heart of the industry's fight against New Johnsonville. TVA's request to Congress for approval of a quick start on the $36.5 million Widows Creek steam station, on the other hand, has been presented virtually as an emergency national security project.

A spokesman for the Atomic Energy Commission cinched the emergency status of Widows Creek at recent House hearings. Of the total power requirements of AEC's Oak Ridge installation, this witness testified, TVA now supplies 225,000 kw. By September this demand will increase to 250,000 kw, by December it will hit 270,000 kw, and by July, 1952, it will be 640,000 kw.

That's about as fast as load growth need be to win an "emergency" label for the program to meet it. In fact, it is faster than TVA, even with an anticipatsl start before July 1, can install 225,000 kw at Widows Creek and a fourth unit of 112,500 kw at New Johnsonville, all of which will be dedicated to the Oak Ridge load. Next year TVA will have to call upon neighboring company systems to the tune of some 100,000 kw to take up the slack until its own new capacity is on the line.

At the same time, there has been no inclination, least of all within the utility industry, to question AEC's estimates of rapidly expanding power needs. It clearly is national policy to step up our atomic energy program, which even before news of the Russian bomb rated as the hottest item in our national security arsenal.

So the industry's attitude toward Widows Creek of necessity differed from its hostile view last year of the New Johnsonville project. The industry never has opposed —and never could—a federal power development seriously tagged by responsible federal officials as "emergency, for national security."

It is interesting to note that the government laid much more careful preliminary plans for Widows Creek than preceded TVA's demand for New Johnsonville. First, a highly qualified Army engineer surveyed the area and came up with the conclusion that it would be more economical for TVA to add new capacity than for AEC to buy the additional energy from power companies. And the National Security Resources Board checked systems interconnected with TVA to make sure they would have sufficient capacity to meet the Oak Ridge demand until Widows Creek is ready.

It would be worth a fight of the proportions of the one over New Johnsonville to persuade the federal government to take as much care in connection with every proposal to build new generating facilities. At the very least, plans for each federal plant should be accompanied by an authoritative study of the availability of power in the area involved and the relative economic feasibility of the proposed federal development.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Ground fault neutralizers are much more common in Europe than here because there is less reluctance abroad to accept sensitive directional relaying to select a faulted feeder from a group leading from the generator bus.

Turbines are usually overhauled after about one year of operation and, on the average, every 3 years thereafter.

Boiler outage time for overhaul is considerable because of the attention required for induced-draft fans and ash pits.

Carrier encounters high attenuation and low impedance arising at odd quarter wave-lengths from the reflections caused by tap lines or untapped extensions.

Arcs will go out at current zero if the fault current is in phase with the voltage, but this, unfortunately, is seldom a natural circumstance.

Flyash from Chicago power stations—140,000 tons—will halve the 685 million pounds of cement otherwise required for the 2,900,000 cu yds of concrete at Hungry Horse Dam. At Chicago it will cost $1 per ton, at the dam $11.50 but save $10 in delivered cement cost. Flyash is really a calcined pozzolan which Romans used in under-water masonry.

Dummy owls have proven quite ineffective in keeping starlings and pigeons away from substations. The pesky things perch right on the fake owls.

Penetrating moisture and poor workmanship or design are considered the two most prolific causes of failures of joints in secondary network cables.

Boilers will again be cylindrical (but vertical rather than horizontal) if the furnace is designed for 200 psi pressure of the combustion gases so that the efflux may do added work in passing through a gas turbine after the water tubes have lowered the gas temperatures to those which the blading can stand.

TYPICAL STREET in overloaded 4-kv semi-suburban Airport Distribution Area near Chattanooga, Tenn., involved in conversion to 7.2 kv

Converting Suburban Area to 7.2/12 Kv Costs Less Than Rebuilding 4 Kv

Economic study shows cost of converting overloaded 4-kv distribution area to 7.2/12 kv is 60% of cost of rebuilding existing system. Better voltage results

JOHN S. McQUEEN
System Planning Section
Electric Power Board of Chattanooga

DISTRIBUTION planning engineers are perennially facing the task of designing distribution systems in the most economical manner that will give the desired quality of service. What this "most economical manner" is will vary among systems and among engineers according to the weighing given some types of distribution.

This article outlines a study that was undertaken by the system planning section of the Chattanooga Electric Power Board to determine the best and most economical method of serving one of the system's 4,000-v semi-suburban residential distribution areas. The particular area involved is fairly densely populated. It lies on the outskirts of an urban district, and is now served by a temporary 1,500-kva, 12,000—4,160-v, 3-ph transformer on leased land.

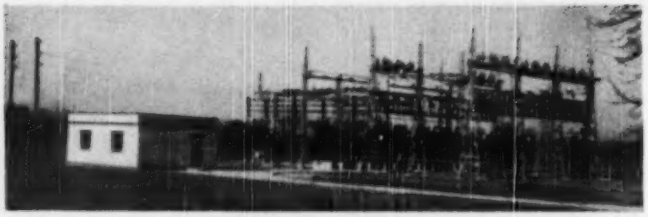
The decision to be made was whether it was more economical to continue serving this growing area with 4,000-v primary—and install a permanent 1,500-kva substation—or convert the entire area to 7,200/12,000-v distribution. The study showed the 7,200/12,000-v conversion to be economical and produced these comparative costs: (1) 4-kv distribution with 1,500-kva structure station . . . $29,500; (2) 7.2/12-kv distribution . . . $15,650—a saving of 47% in favor of conversion to the higher voltage.

Moreover, the study established that if the area in question was served at 4 kv with a 1,500-kva permanent substation, and future load growth should warrant an additional 1,500-kva transformer station, the differential cost favoring conversion to 7.2/12-kv distribution would be even more favorable. Load forecasts now indicated that the area load would reach 2,500 kva by 1954.

Therefore, it seems economical that in any similar area where the load warrants the construction of a standard structure 12,000/4,000-v substation of 1,500-kva capacity, or the installation of a unit substation, the area should be converted to 7.2/12 kv for greatest over-all economy.

The particular area involved in this study is called the Airport Distribution Area. It is a relatively small portion of a larger system area that

Study shows conversion to 7.2/12 kv is most economical plan for serving overloaded semi-suburban system



SHEPHERD PRIMARY SUBSTATION rated at 20,000 kva, 44/12 kv serves the area east of Missionary Ridge

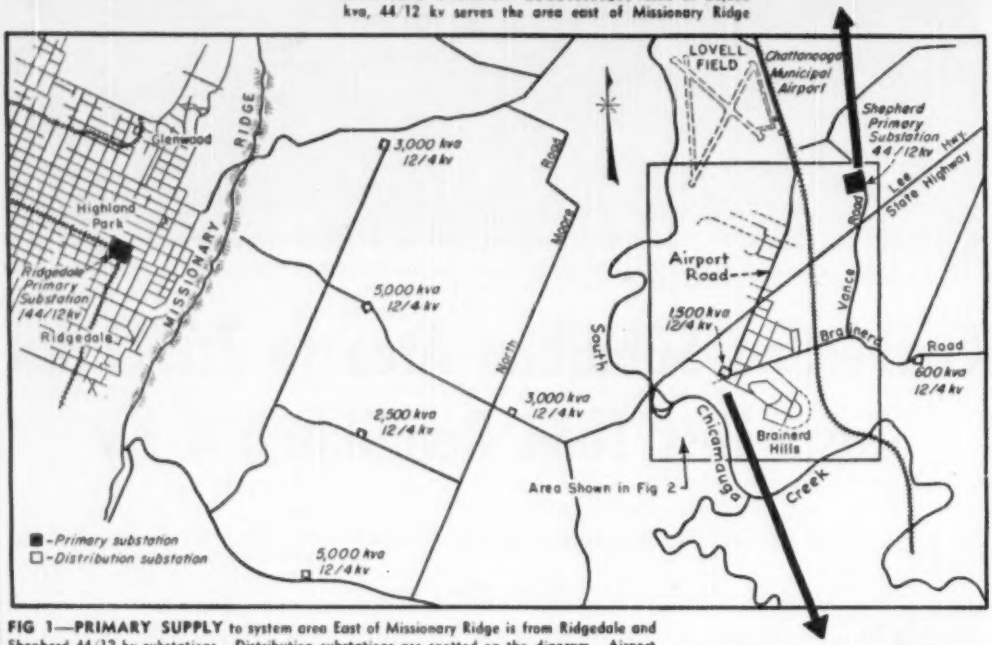


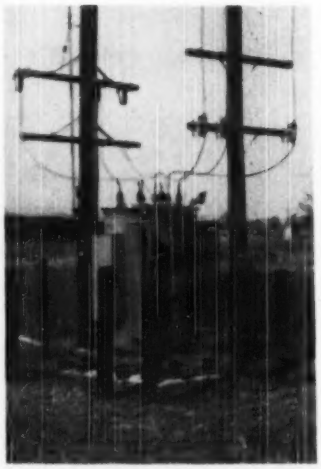
FIG 1—PRIMARY SUPPLY to system area East of Missionary Ridge is from Ridgedale and Shepherd 44/12-kv substations. Distribution substations are spotted on the diagram. Airport Distribution area under study is East of Chickamauga Creek, in vicinity of Brainerd Hills

lies east of historic Missionary Ridge, Fig 1. Until 1947, load in the area east of the Ridge was about 12,000 kva. It was supplied through the 42,500-kva Ridgedale 44/12-kv primary substation. In that year, however, a second primary substation called Shepherd, and having a 44/12-kv capacity of 20,000 kva, was installed in East Brainerd to relieve Ridgedale and improve service east of Chickamauga Creek.

Today Ridgedale is serving about 16,000-kva load in the area east of Missionary Ridge and Shepherd 13,500 kva. Thus the load in this particular territory has increased 146%.

Airport Distribution Area, shown more in detail on the circuit map of Fig 2, is one of five areas comprising the section east of Chickamauga Creek. Two years ago it was agreed to convert all this area east of Chickamauga Creek to 7.2/12-kv distribution with the possible exception of the Airport Area. This area has a higher load density than the other areas. Consequently a possibility existed that it was economically feasible to continue to serve this area at 4 kv. The other areas east of the Creek, however, had reached their economical limit at 4 kv. This was not necessarily a load limit but rather a voltage spread limit which was imposed by the distance of the load from the 4 kv distribution substations, which comprised three 200-kva, 12,000/4,160-v transformers.

At the time that the conversion study was undertaken in 1948, Airport Area load had grown from its



TEMPORARY SUBSTATION comprised of a 1,500-kva, 3-ph, 12/4-kv transformer now serves area to be converted to 7.2 kv

1940 value of 254 kva to a peak of 1,600 kva on the temporary 1,500-kva, 12,000/4,160-v, three-phase area transformer station at the intersection of Airport Road and East Brainerd Road (Fig 2).

In addition to analyzing the comparative economics of converting to 7.2/12 kv or serving the area at 2.4/4 kv, service continuity to the customer was also a consideration in the study because operation of a 7.2/12-kv distribution is more difficult and dangerous than 4-kv distribution. Trouble on 4 kv can be cleared more simply since it can be worked with rubber gloves. Trouble on the 7.2/12-kv system has to be sectionalized to be cleared, or worked with hot sticks.

The economic analysis began by ascertaining conditions existing as to the size of line conductors, kva capacity connected on feeders, and known future loads in the area. Using the information given on 4-kv and 12-kv primary area record maps, a primary voltage study of the area was made. From this, the loading on existing facilities and consequently the primary voltage drop to be expected at any point in the area was found, using the methods outlined by C. E. Arvidson in ELECTRICAL WORLD in the 1939 Oct., Nov. and Dec. issues. This method is based on a unit voltage drop constant per 10,000 kva ft for each size conductor. Knowing the distance between successive kva connected loads and the kva connected capacity, it is possible to calculate primary voltage drop. An example of the calculations is tabulated. The calculated voltage drop given by such tabulations, while only an estimate, is accurate enough to be acceptable. When corrected by the demand factor for the area it closely approximated actual measured drop.

Primary Circuit Calculations—4 KV

Station Number	Distance in Ft Between Stations	Conductor Size	Transformer KVA At Sta	Transformer KVA From Last Sta	Kva-Ft 10,000	Primary Voltage Drop Unit	Primary Voltage Drop Between Sta	Primary Voltage Drop From Substa
Y-1031	500	3 φ-#6	85	700	36.00	0.0302	1.19	1.19
Y-1014T	300	.....	37½	695	10.80	.....	0.63	1.82
X-4013	700	1 φ-#6	15	77½	5.46	0.1814	0.98	9.23
X4015	200	.....	5	15	0.30	.....	0.05	11.35
X-1010	1900	.....	10	10	1.20	.....	0.22	11.57

Values of these primary voltage drops are given in Fig 2 for the last connected transformers on the main feeds from the substation. They are based on the existing conditions of the distribution circuits with the substation in its temporary site—the intersection of Airport Road and East Brainerd Road. On this system the maximum voltage drop allocated to the primary is 3 v.

The 4-Kv Plan

Trial calculations, using the existing conductor and the magnitude and location of estimated future loads, established that if this area was to be served at 4 kv, the permanent location of the substation should be on Walker Road. This location offered the following advantages:

1. It would be centrally located with respect to present and future loads
2. It would require the minimum amount of conductor changes
3. A two-way 12 kv source of power would be available
4. Station would allow two 4-kv feeds into the center of the 4-kv load.

4-Kv System Changes

With this assumed location of the station, the primary voltage drops were calculated again to determine what primary conductor changes would be necessary. These drops are also shown in Fig 2. The conductor changes necessary to bring the primary voltage drop within the acceptable limits are listed:

1. Install a 3-ph, 12-kv, No. 2 conductor line from Lee Highway to East Brainerd Road on Walker Road. The line would loop into the station and be tied into two separate 12-kv lines out of Shepherd primary station.

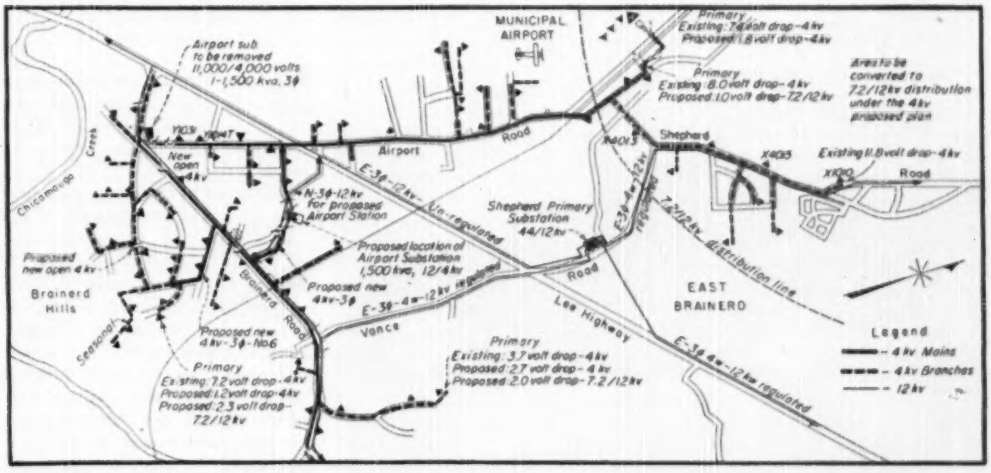

MUNICIPAL AIRPORT
Airport sub to be removed 11,000/4,000 volts 1-1,500 kva, 3φ
Primary Existing: 7.4 volt drop-4 kv Proposed: 1.8 volt drop-4 kv
Primary Existing: 8.0 volt drop-4 kv Proposed: 1.0 volt drop-7.2/12 kv
Areas to be converted to 7.2/12 kv distribution under the 4 kv proposed plan
Y1031
Y1014T
X4013
Shepherd
X1005
Existing 11.8 volt drop-4 kv
X1010
Airport
Road
New open 4 kv
4-N-3φ-12 kv for proposed Airport Station
E-3φ-12 kv-X/R-regulated
Shepherd Primary Substation 44/12 kv
E-3φ-4 kv-12 kv regulated
7.2/12 kv distribution line
Chickamauga Creek
Proposed location of Airport Substation 1,500 kva, 12/4 kv
Proposed new 4 kv-3φ
E-3φ-4 kv-12 kv regulated
Proposed new open 4 kv
Brainerd Hills
Brainerd Road
EAST BRAINERD
Seasonal
Proposed new 4 kv-3φ-No.6
Vance
Lee Highway
Primary Existing: 7.2 volt drop-4 kv Proposed: 1.2 volt drop-4 kv Proposed: 2.3 volt drop-7.2/12 kv
Primary Existing: 3.7 volt drop-4 kv Proposed: 2.7 volt drop-4 kv Proposed: 2.0 volt drop-7.2/12 kv
E-3φ-4 kv-12 kv regulated
Legend
4 kv Mains
4 kv Branches
12 kv

FIG 2—CIRCUIT MAP of Airport Distribution Area shows existing 4-kv circuits and proposed additions. Also shown are the existing 12-kv lines in the area. Primary voltage drop at last transformer is given for existing system, proposed 4 kv and proposed 7.2/12-kv plans.

2. Install a 3-ph, 4-kv, No. 2/0 conductor line on Walker Road from the substation to Airport Road and to East Brainerd Road.

3. Installation of a new 3-ph feeder tap off East Brainerd Road and tie into the Brainerd Hills distribution. This will give two feeds into this area and split the load so that the primary voltage drop in this area to any transformer from the substation will be 3.0 v or less.

4. The No. 2/0 conductor 4-kv line from the substation to Airport Road would split the load on this feeder and the primary voltage drop to the last transformer would be 3.0 v.

5. Due to the prospects of an increase in load at the Municipal Airport and the proposed construction of a 12-kv, 4-w line along Shepherd and Vance Roads, it was decided that this area should also be converted to 7.2/12 distribution.

Cost Comparison

After determining the facilities required to provide adequate service to the area under each condition, cost determination was the next step. The cost of the 4-kv structure substation, including the cost of the lot and the 1,500-kva regulated station with all the necessary components would be $24,000. The cost of the overhead line requirements including material, labor, engineering and overhead would be $5,359. This gives a total cost of $29,359 for an adequate 4-kv distribution system for the Airport Area for an ultimate load of 1,875 kva. Any additional load growth in this area would require additional substation capacity and perhaps line conductor changes.

The economics of converting the Airport Area to 7.2/12-kv distribution, involved consideration of the existing 3-ph, 4-w, 12-kv circuits out of Shepherd Substation that are shown in Fig 2. These existing 12-kv circuits would be used to the fullest extent and with the minimum conductor additions.

For comparative purposes, Fig 2 shows the primary voltage drops at 7.2/12 kv. The primary voltage drops are calculated from Shepherd Substation to the distribution transformers, and were obtained in the same manner as the 4-kv voltage drops, the only difference being in the unit voltage drop constant per 10,000 kva ft. One advantage of 7.2/12 kv over the 4-kv distribution is that the same conductor will carry approximately three times the load as at 4 kv or will reach out nine times as far for the same voltage drop.

The cost of the work chargeable to overhead lines in the conversion was $5,800. The net cost of the new 7.2/12-kv distribution transformers to be installed was $6,100. This net cost was obtained by subtracting the value of new 2.4/4-kv transformers from the cost of the new 7.2/12-kv transformers. It is realized that this does not give a true comparative net value of the transformers. However, these 2.4/4-kv transformers are comparatively new for the most part, and are of such kva size that they can be used elsewhere on the system. In addition a proportionate cost of a 12-kv regulator at Shepherd Substation must be charged to the regulation of this 1,500-kva load. This cost is approximately $3,750. Thus, the total estimated cost for conversion would be $15,650.

Comparative costs for the Airport Area are as follows:

1. 4-kv distribution with 1,500-kva structure station	$29,500
2. 7.2/12-kv distribution	15,650
Difference	$13,850

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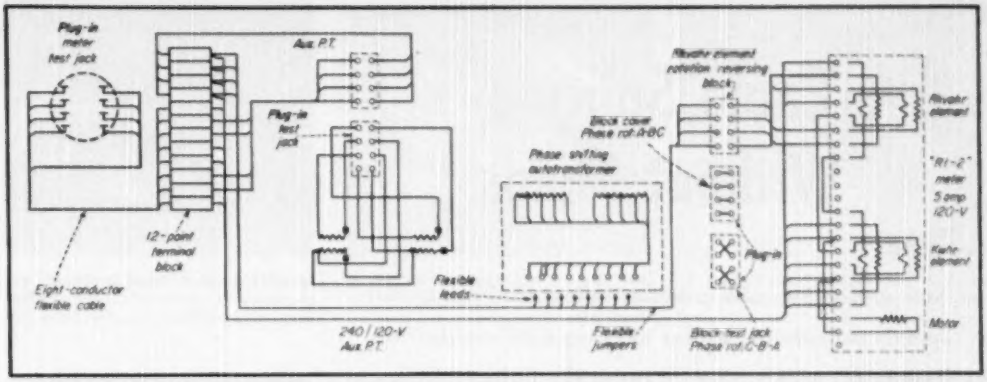
Automotive Standardization Reduces Parts and Service

W. P. POSTELL
Supt of Shops and Transportation
Alabama Power Co
Birmingham

STANDARDIZED line truck type body is used on a 2½-ton truck for operation and maintenance. Construction type body is used on 1½ and 2½-ton trucks engaged in construction

BY SELECTING cars and trucks on the basis of suitability, initial cost, economy of operation and availability of parts and service, the number of makes is minimized.

Alabama Power Co now uses three truck sizes—½, 1½ and 2½ tons -- with five body types. There are three types for ½-ton trucks: standard pickup, pickup with side-mounted utility boxes and overhead ladder racks, and a specially designed local-operations body. In addition, different bodies are necessary for a few requirements such as earth augers and aerial ladders. One winch size (18,000 to 20,000 lb) has been selected for all midship installations.



PORTABLE METER requires a minimum of field connections. All leads except those to autotransformer are connected by plugging in blocks or test jacks. Connection of flexible leads to autotransformer is determined by voltage and type of supply at customer's meter

Portable Meter Checks Power Factor

E. H. TATE
Meter Superintendent
Jackson Electric Department
Jackson, Tennessee

ENFORCEMENT of the power factor clause in Jackson Electric Department's industrial and commercial rate schedules is being carried out by a portable, recording kw and kva demand meter. This economical method of checking power factors (1) Has produced an increase of about 2% in the system power factor; (2) enables the department to check an average of two customers per meter per month; and (3) requires only 2½ hr for disconnecting and reconnecting at a new site, at a cost of $7.50 including transportation. In addition, the meter produces a record of kva and kw on the same chart, thereby aiding the sales engineer in his explanation of power factor and the need for capacitors to plant managers who may not be technically trained.

On the Jackson electric system, socket type indicating demand meters are used almost exclusively on customers of less than 1,000 kw. Two element meters are used on instrument transformer installations. Therefore, the meter chosen for portable service was type "RI-2", two-element, 120-v, 5-amp meter. This unit is similar to permanently installed two-element meters on the system.

The meter and its required accessories are mounted in a large instrument transformer cabinet. Fitted with cross-arm hangers equipped with levelling screws, the cabinet may be set on the floor or hung on any convenient support. Cost of the meter, including equipment cabinet, cables and labor, was about $526.

The meter and cabinet are wired according to the wiring diagram shown. Because hook-up time in the field has been minimized, much time is saved when the meter is moved from place to place. A 20-ft, eight-conductor control cable connects the meter to the customer's meter socket through a test jack. Changes from three-wire delta to four-wire delta to four-wire wye may be made quickly by changing flexible leads to the phase shifting autotransformer, and by plugging in or removing the auxiliary 2:1 potential transformers. Auxiliary transformers are required only on 240-v customers and are left at the meter shop when not needed.

Phase Rotation Checked

Phase rotation is checked at the meter socket. Rotation of the reactive element on the portable meter is held unchanged by inserting a cover into a test block for A-B-C rotation, or is reversed by inserting a test jack with cross connections for C-B-A rotation (see wiring diagram). The phase-rotation check is made to determine for sure whether the customer's power factor is leading or lagging, although a leading power factor is extremely rare.

In use, the portable meter is left in service long enough to record the customer's normal peak kw demand. The regular meter is then re-installed and the portable meter is moved to the next smaller customer. If the customer's power factor at peak load is above 85%, no action is taken. If his power factor is less than 85%, the sales engineer explains the situation to the customer, tells him the approximate cost of correction, and the approximate extra cost of power if the condition is not corrected. He also gives the customer a copy of the book *Power Factor In Your Plant.*

Customers Can Rent Capacitors

After a short time, the sales engineer again contacts the customer and offers his assistance in planning the installation of capacitors. Customers who don't desire to purchase capacitors may rent them from the department, at 1% of their value per month. Should a customer refuse to correct, a tapped phase-shifting autotransformer and an indicating demand meter are installed to read peak kva at the power factor determined by the portable meter. The customer is then billed accordingly.

It is anticipated that each customer above 50 kw will be checked by the portable meter at least once every two years. Additional portable "RI-2" meters will be wired if necessary.

Cable Splicing Without Molds

New method results in better vulcanized joints and speeds up splicing under varying field conditions. Test joints of No. 12 Awg generally failed at 50 kv, dc; "cure in tape" joints usually withstood 75 kv

DONALD W. KITCHIN
Research Laboratory
Simplex Wire & Cable Co
Cambridge, Mass.

A NEW and effective method of making vulcanized joints and patches in rubber-covered cables without metallic molds is now available. Essential feature of this method is the use of pressure tapes around the joint during hot vulcanization in a heating unit. Most important benefit of the "cure in tape" technique is the outstanding superiority of the electrical quality of joints or patches over that produced by conventional molding procedures. In addition, four or five sizes of heating units will cover a very wide range of wire sizes, thereby effecting a saving that may run into the thousands of dollars where a wide range of wire sizes is handled. This "cure in tape" method is also applicable for making patches on heavy twisted conductors with relatively thin insulation.

Critical Tests Performed

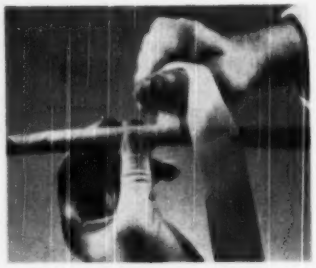
Critical tests illustrate the outstanding superiority of the electrical quality of splices made by the new method. In a series of joints made on No. 12 Awg wire with 6/64-in. insulation thickness, those made by conventional molding procedures would usually pass a test at 25 kv dc but generally failed at 50 kv dc. Those made under the "cure in tape" method almost invariably withstood 75 kv, dc. The difference in quality is most strikingly shown by megohm measurements during three months' soak in water at 158 F, followed by dc breakdown and examination of the joint for looseness between layers. Joints made the new way maintained high insulation resistance, showed breakdown strength comparable to that of the core and revealed no looseness between layers. Molded joints rarely passed these tests.

Of 22 joints made by the normal procedure and vulcanized in a metal mold, all failed during the 158 F soak by showing a megohm drop of several decades in from one day to six months. A group of 12 consecutive joints cured in tape gave the following results: After one day at room temperature, the joints were stressed 5 min at 100 kv dc, with no failures. After three months' load at 158 F there were no megohm failures and the average resistance was 7.5 million megohms. On destructive breakdown tests only five failed in the joint proper; four in the core. There were three end-flashovers. The average voltage for all 12 test joints was 90 kv dc.

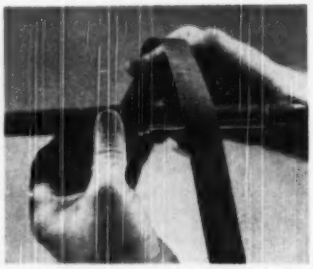
This great increase in dielectric strength can be principally attributed to the improvement in structure. This is shown in the illustrations of cross-sections of joints wrapped with alternate layers of black and white rubber (Fig 11). In the molded joint the layer structure is disturbed by the flow of stock as the mold is closed. The radially oriented interfaces almost result in low breakdown strength at the "fin" or "flash". In joints cured in pressure tapes, the unbroken concentric layers impart a structure of high inherent dielectric strength.

Choice of the heating method is dictated mainly by convenience. Various ways of heating can be used without lowering the final quality. In early work over 100 experimental joints were vulcanized by radio frequency heating. However, units like that illustrated are more flexible and less expensive. For very small sizes

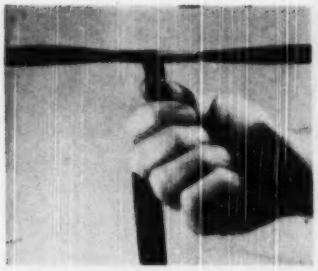
1 APPLY rubber cement in smooth "varnish" layer. Dry with hair dryer, infrared lamp or by holding splice over curing unit



5 APPLY pure gum rubber strip to compress splicing stock. Strip is about 20 mils thick and is pulled to its limit of stretch. Strip is left on for 2 min and then removed



8 BLACK code tape is applied with about 50% overlap. This black tape provides a surface for absorbing radiant heat and binds copper tape firmly around the splice

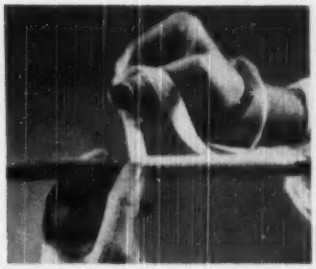


2 CAREFULLY WRAP on rubber splicing tapes with 50% overlap, moderate tension, starting ½–1 in. outside pencilled scarf

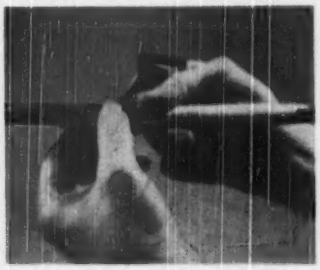
3 PREFERRED METHOD is to wrap tapes in contours. Note that each successive layer is started nearer the splice center

4 CODE TAPE "straight jacket" is applied with customary longitudinal joint overlapped to secure a good conductor center

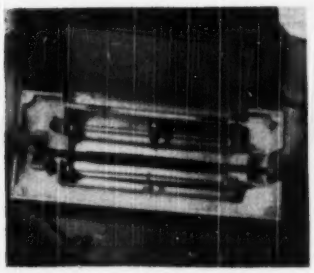
NOTE: When maximum electrical stability in the presence of moisture is not required, the straight jacket and the rubber squeeze (Steps 4 and 5) can be omitted and the joint cured in Cellophane tape. The metal tape can then be omitted except when several conductors must be cured simultaneously.



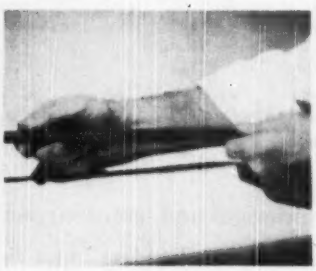
6 WRAP cotton binder tape, ½-in. wide, tightly with 50% overlap. This pressure tape holds the 1-1.5% compression applied to splicing stock by gum rubber strip (Step 5)



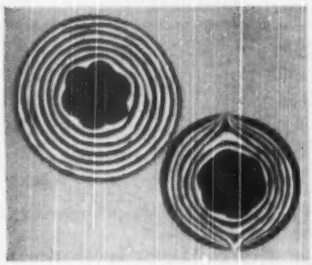
7 APPLY tinned copper tape. This tape is used to distribute heat uniformly. A high degree of vulcanization is necessary to insure superior electrical qualities



9 JOINT is cured in vulcanizing unit for 1 min or up to 30 min, depending on conductor size and wall thickness. Operating temperature for medium-sized joints—400 F



10 VULCANIZED JOINT after removal of copper tape and cotton tape. If desired, straight jacket may be removed. Note splice has lost taped-joint appearance



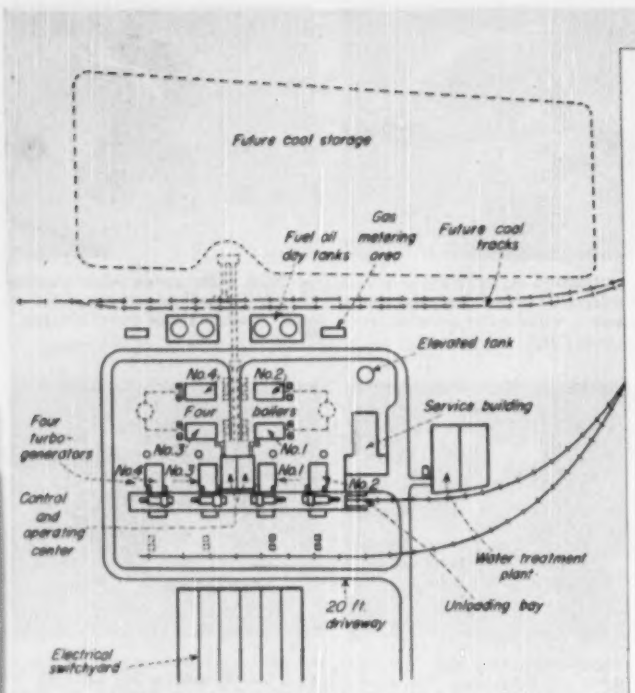
11 CROSS-SECTION of joint "cured in tape" (left) shows intact layer structure. Cross-section of joint cured conventionally (right) shows disruption of layers

of conductors, an infrared lamp with a small reflector to focus the rays on the patch is suitable. For larger sizes, curing units with several heating coils have been found most convenient. Four or five such units will cover a very wide range of wire sizes. Units can readily be designed for either T or Y joints.

The wide range of sizes which can be handled by this method is illustrated by the following extremes which have been successfully patched or spliced—from No. 18 wire with a 15-mil wall of rubber insulation up to 2 Mcm cables having 2.5-in. outside diameter over the insulation. During the recent war the feasibility of curing in pressure tapes in radiant heating units was shown by the repair of a badly damage 3-conductor 4/0 shovel cable. Twenty-five conductor patches and one 7-ft jacket patch were made. Adjacent patches on all three conductors were also made at that same time.

Uniform Quality with Different Operators

This method of jointing is easily learned by new operators. Joints made by different jointers have shown uniformly high quality. Where the quality requirements are not so severe, the procedure can be simplified somewhat by omitting Steps 4 and 5, shown here for completeness.



Advantages of Duplication and Coordination

Duplication is extended to the selection and purchase of equipment not already committed for; to specifications; purchase orders, etc.

Duplication of spares is minimized thus keeping this component of investment to a minimum.

Had separate designs been used, considerable time would have been consumed in individual engineering and design. The use of a common design requires about 38% fewer drawings, and of the reduced total some 30% will be single drawings serving the three plants.

The plant design is flexible; extensions can be made with larger or smaller units. The future units need not be of opposite "hand."

Some compromises were made and this was inevitable; however, the merits of each situation were considered with compromise representing a decision on an economic basis.

It is believed that the step taken by these three utilities represents a worthy achievement and is indicative of what can be accomplished in those situations where the common interest of several members of a unified system is brought to bear on such problems.

FIG 1—SAME DESIGNS serve for construction of three practically identical plants for three constituents of new Middle South holding company. Foundations are varied to meet earth conditions, otherwise alike. More uniform maintenance program is a corollary benefit

Savings in Common Design

Opportunity for concurrent design and construction of three plants leads to economies in drafting, specifications, purchasing, spares, interchange of operating staffs. Sites found or chosen to be conducive

P. E. GOURDON
Chief Mechanical Engineer
Ebasco Services, Inc., New York

WHEN a situation so warrants, substantial savings in capital investment are possible if a common or duplicate design can be used for more than one project. Engineering costs are lowered, fewer total drawings are needed, duplication of specifications and studies is reduced, mass purchasing of many items is possible, and fewer total spares are involved as an interchange program can be worked out.

There are other corollary advantages; more uniformity in a maintenance program, and operators can be interchanged quickly when emergencies require it. This is because central control centers can have identical instrumentation and the arrangement of the plant equipment and layout of piping systems are similar.

Managements of utilities and industrial enterprises are being confronted continually with higher investment and operating costs and this imposes upon them a search for means to reduce these costs. This article describes how the efforts of three companies were applied to achieve certain economies in plant investment and resulting operating costs.

The economies resulting from the program later described were possible because of the unified planning and development of the integrated holding company system of which the individual companies are a part. The program had its inception in connection with the purchase, to speed completion by the holding company, of

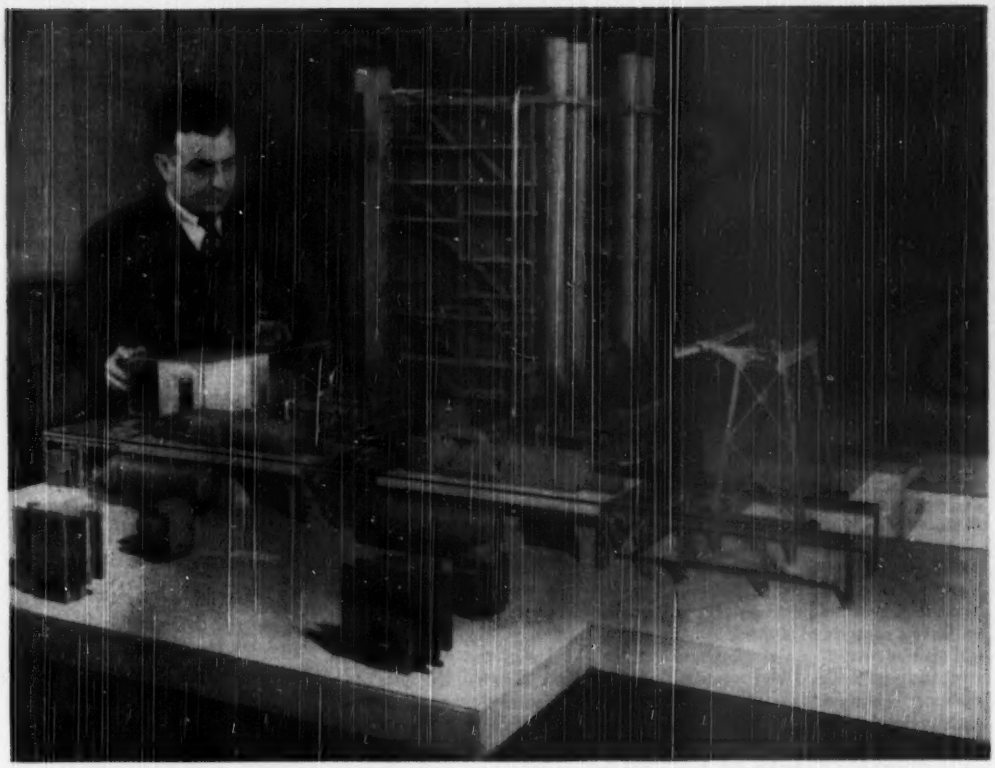


FIG 2—FINAL DECISIONS and the refinements of station design detail were worked out on the carefully constructed scale model, above. Relative locations of major equipment had been previously evolved by manipulation of an earlier temporary model (see Fig 3)

For Several Power Plants

a group of 60/66-Mw turbogenerators and associated equipment before engineering studies to determine location had been completed. To achieve the lowest ultimate cost of the power output, including both fixed and operating costs, unusual effort was directed toward standardization for three projects on a design embodying features calculated to achieve a maximum of economy and reliability.

Three Steam Projects

The Arkansas Power & Light Co, Louisiana Power & Light Co and Mississippi Power & Light Co, members of the Middle South utilities system, are carrying out extensive expansion programs to supply the ever growing development of the areas they serve. Their programs include substantial capital investments for new plant capacity and to the end of keeping plant investment to a minimum they carried out a program of coordination and cooperation to achieve duplication of plant design for three plants that are now under construction.

The Arkansas Power & Light Co is constructing one of its new steam electric stations, the Hamilton Moses plant, near Forrest City in Eastern Arkansas. The installation will comprise two 60/66-Mw turbine-generator units each served by a single steam generating unit. Induced-draft cooling towers will handle the condenser circulating water. The site is gently rolling and grades down gradually to L'Anguille River. The area occupied by the plant and switchyard has very little grade differential. The foundations will be on natural soil.

The Louisiana Power & Light Co is constructing a new plant at Ninemile Point on the Mississippi River opposite New Orleans. The turbine-generator unit will have a capacity of 60/66 Mw and will be served by a single steam generating unit. Condenser circulating water will be taken from the river. The site is relatively flat although there is a gentle grade to low swampy ground some distance from the area occupied by the plant. As is fairly common in this territory, piles will be used.

The Mississippi Power & Light Co

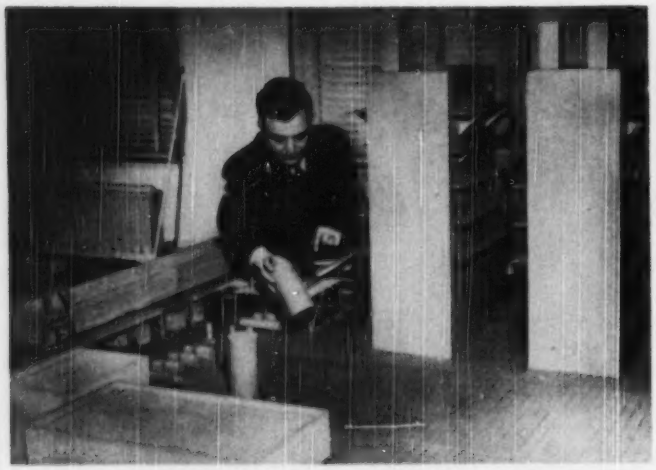


FIG 3—MODEL ELEMENTS placed on a scaled ground plan greatly facilitated early group discussions of a plant layout feasible for all three sites. Final details were embodied in a permanent model, Fig 2. Drawings would mean expense and less convenient group study

is constructing its new Natchez Steam Electric Station in the vicinity of Natchez. The turbine-generator unit will have a capacity of 60/66 Mw and will also be served by a single steam generating unit. Condenser circulating-water cooling will be effected by induced-draft cooling tower. The general ground area is gently rolling but it is cut by a number of deep ravines which made difficult the orientation of the plant. Like the East Arkansas project the foundations will rest on the natural soil.

All turbine-generator units are the AIEE-ASME Preferred Standard, 1,250 psig, 950 F. The basic fuel is natural gas, with fuel oil, when used, for standby and emergencies. Plants are designed for future use of pulverized coal.

A preliminary review indicated that a common plant design was possible notwithstanding certain differences between the sites and in the make of the major equipment.

Coordination Measures

To crystallize the plan the three companies initiated a general meeting, held in Jackson, Miss., in which participated their executives, engineering and operating staffs, the system operator of the Middle South System, and members of Ebasco construction and engineering staffs. The group totalled 31 persons.

As the meeting was to consider details as well as general problems, in the interest of economizing time and to facilitate presentations and discussions, certain preparations were made.

A general plan was drawn up for each project showing the practicability of disposing the plant and switchyard end on each site so that the "hand" would be identical. Initial studies have been made by manipulating templates on a drawing of each site. The Hamilton Moses two-unit installation (Fig 1) illustrates the overall general arrangement that was chosen. The road surrounding the plant is the same for all, but the approach roadway is varied to suit local conditions.

Functional Model Expedites Solution

A functional model, to the scale of $\frac{1}{4}$ in. = 1 ft was prepared, showing disposition and relationship between plant structures and major equipment. The base of the model (Fig 3) was scaled and the structure and equipment components were free to be moved about —to enable ready consideration of alternate dispositions. The use of the model was decided upon, after careful consideration had led to the conclusion that a very large number of preliminary drawings of alternate designs would have to be prepared to present properly the various possible arrangements; the preparation of these drawings would have consumed time and entailed substantial expense and would have been far less convenient for presenting alternate ideas to a fairly large group. The model was set up so that it could be studied and observed while the presentations proceeded.

The model served an additional useful purpose in permitting an immediate and complete analysis of spacing to yield best arrangement from an operating and maintenance standpoint.

Essential mechanical piping, operational and electrical main and auxiliary one-line diagrams were prepared and mounted to facilitate the discussions.

In executing the plan of duplication of design it was essential to achieve agreement on a common design for the control and operating center. Therefore, a full-scale model of the control boards, mechanical and electrical, was set up on a frame (details later).

Identical Configuration

The general arrangement was selected on the basis of an ultimate plant to comprise four units controlled and operated from one common control or operating center (Fig 1). Relative position of all structures, the principal equipment, the service building, step-up substation, roadways in the plant area, plan of expansion, and other details, are the same.

Semi-outdoor design is used as experience has demonstrated its economic and practical usefulness in these areas. The outdoor features are used to a somewhat greater extent than ordinarily conceived for this type of design.

As the soil conditions differ between the sites, the foundations will be specific for each situation. Complete duplication is not practical for this phase of the design, except that for Hamilton Moses and Natchez plants the fundamental engineering is duplicated, the difference being negligible.

One Set of Drawings

From grade up, duplication is carried throughout except for minor departures occasioned by the variations between the different makes of equipment.

Superstructures are identical so that one set of drawings will serve

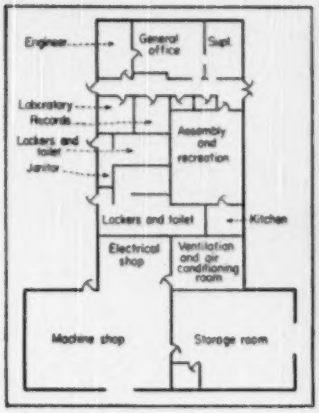


FIG 4—SERVICE BUILDING is the only building, all other structures being enclosures for apparatus or supports for them. Storage space is temporarily augmented by using under boiler space meant for future ash hoppers

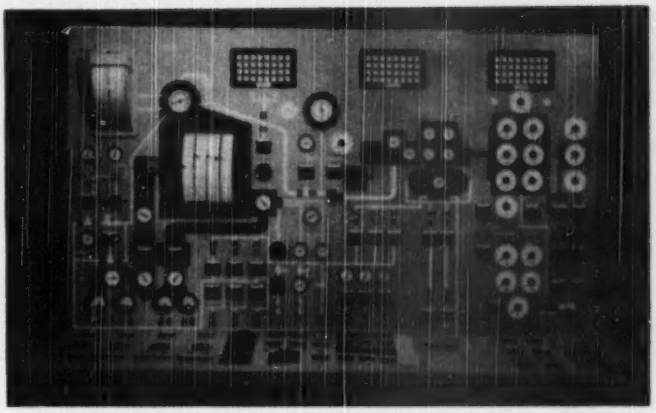


FIG 5—FUNCTIONAL DESIGN of the central control board shows operator the indications in terms of circuit sequence for both mechanical and electrical systems in the plant

the three plants. For reasons of economy the walls will be of brick at Hamilton Moses and concrete block at Natchez and Ninemile Point.

The single story service building (Fig 4) is of relatively low-cost construction. It is of common design and provides offices, laboratory, assembly hall, locker rooms, wash-room facilities, machine shop and storage proportioned to serve three units and perhaps four. To accommodate the special requirements of one of the projects the service building has one added bay for storage. Supplemental storage is provided by a light enclosure of the volume under the boiler floor, as the boilers are raised for future ash hoppers.

Central control and operating centers cater initially to the one or two units to be installed but are capable of development so that ultimately this center will control four units or a total of 250 to 300 Mw.

Convertible to Coal

The turbine-generator units are in line and the steam generating units are disposed as indicated to facilitate subsequent conversion to pulverized coal. Such an arrangement results in minimum initial investment and allows great flexibility for the future coal design.

A four-point (five-point future) regenerative cycle, utilizing condenser deaeration, is chosen. The arrangement of all auxiliary equipment is the same for each unit. Similarly, the electrical designs are common for the plant. As only one set of drawings is needed to cover a substantial portion of the designs it is possible to effect interesting economies.

Functional Board

The electrical and mechanical boards are in a common control room and the boards are of a functional design developed some time ago for another client. They are of the walk-in type. The design reduces the usual length of the board by about one-half and likewise the size of the control room. The control room is air conditioned.

This board utilizes gages smaller in diameter than usual. The arrangement (Fig 5) is more functional than customary. Instruments such as recorders, which serve no direct operating function but merely produce records, are removed from the front of the board and placed in the walk-in section; these instruments as well as the electrical relays are carefully arranged for accessibility and maintenance. All high-pressure steam and water lines are excluded from the room, the impulses being transmitted to the instruments in the control room either by low-pressure air or electrically, or by both methods. The board is developed to cater to three fuels: natural gas, oil and coal. The benchboard section accommodates combustion-control devices and auxiliary electrical switches.

Functional arrangement of the instruments should render operation more convenient and decrease hazard of confusion at time of emergency. In conjunction with the unified design it should also greatly facilitate interchange of operators between plants for relief and other purposes with a minimum of training and familiarization.

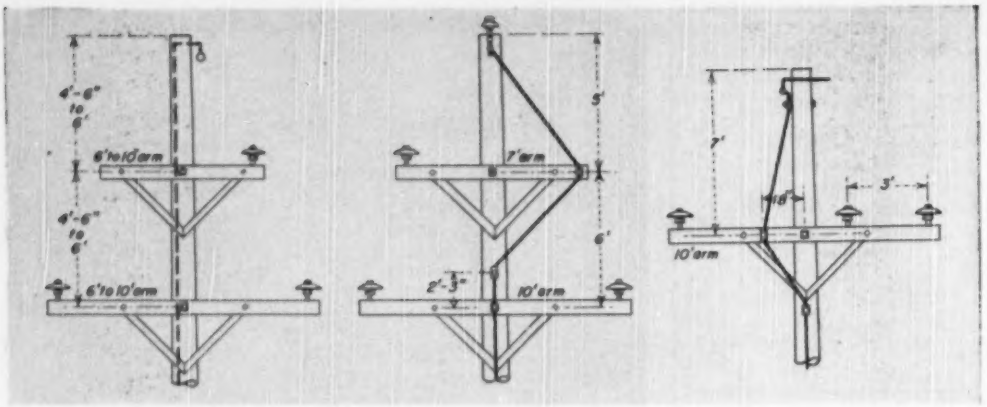
To a great extent the idea of duplication is being carried out in the switchyard except that, in some respects, system considerations did not permit going the entire road.

• • •

Dry Ice Puts Out Fires In Coal Bunker

FIRES in coal bunkers at generating stations waste money in two ways. Men have to be paid to extinguish them and the coal wasted in the fire costs money.

At Consolidated Edison Co of New York, Inc, experiments with dry ice indicate that it can be used as a satisfactory and economical means for fighting the bunker fires. For the average fire approximately one pound of dry ice is used for every two to three tons of coal in the bunkers. The dry ice is placed in holes made about three feet deep and then covered with coal. As the dry ice evaporates, the carbon dioxide gas that is released extinguishes the fire.



1 **TWO-ARM** construction and pole-mounted ground wire support is most widely used. Arms are sometimes same length

2 **INCREASED CLEARANCE** is provided between grounding down-lead and top conductor by using this variation

3 **SINGLE-ARM** construction for three conductors is seldom used since there is a large reduction in the conductor spacing

Survey of 34.5-46 Kv Practices

Use of overhead ground wire increasing, but wood insulation value is not being utilized. Simple chart plotted for coordination of dimensions and resistance

FRANK E. SANFORD*
Consulting Engineer
Line Material Co
Milwaukee

THERE appear to be more questions and differences of opinion regarding the design of transmission lines for operation at voltages in the range of 34.5-46 kv than on any other present phase of transmission. Pin or post type insulators on wood crossarms with wood braces are almost universally used for this voltage class construction. Major questions, however, concern the use of overhead ground wire protection, and the values of wood insulation and conductor spacing.

Transmission lines with suspension insulators supported on steel towers have received the major attention in lightning protection studies. The most generally usable data for new designs apply to this type construction, with application of overhead ground wires and low grounding resistance accepted as desirable practice. Several reports in recent years have shown specific designs and operating results for 34.5-kv lines, but the data are not as extensive and the conclusions have not been generally accepted in practice as in the case of the higher voltage lines.

Information on variations in design was gathered as part of a survey of transmission line construction made for Line Material Co. The utilities, engineering service organizations and the government agencies visited are associated with operation of about 25% of U. S. transmission line mileage. Purpose of this report is to present a review of design practices and suggest need for further consideration in this section of transmission construction.

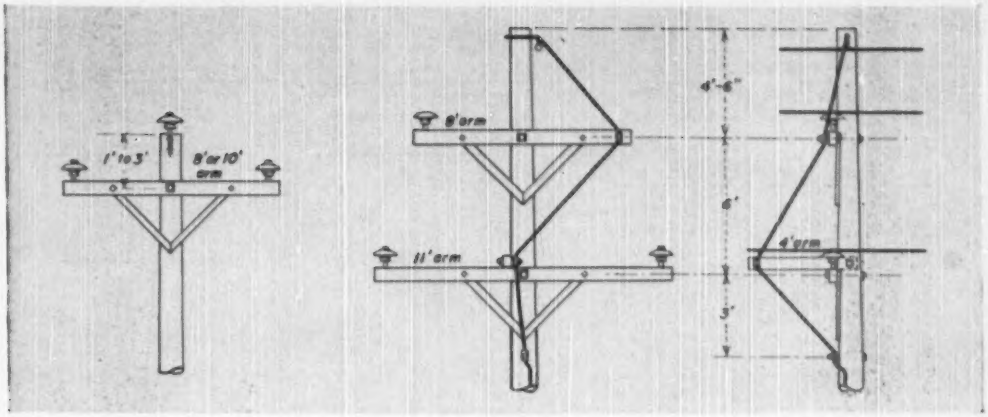
34.5-46 Kv Transmission

More than one-half of the total mileage of lines above 23 kv is in the 23-44-kv range, according to Federal Power Commission statistics. Considering that a part of the milage listed in the next voltage group (45-66 kv) is of similar construction and rated 46 kv, it appears that there are three times as many miles of this voltage class line as there are of steel structures for the higher voltage circuits. Also, the survey indicates that about two-thirds of the total miles of line now planned to be built in the next five years will be for operation at 34.5 to 46 kv.

General use of these lower voltages and transmission lines is for supply to distribution systems, particularly in the eastern, central and midwestern states. Higher voltages are used in the southern states. On an isoceraunic map the majority of the 34.5-46-kv lines are therefore in the area of 40 to 60 thunderstorms per year.

Rebuilding of lines now in service is a large factor in the construction plans. Some utility companies estimate that up to 50% of their subtransmission system mileage must be rebuilt in the coming few years. Physical depreciation as well as load requirements make this program necessary. Extensive changes from 13.2 kv operation to the higher voltage are also indicated in the plans

* Mr. Sanford is now with Commonwealth Services, Inc, Jackson, Mich.



4 **POLLE RIDGE BRACKETS** and single arms are generally used for lines on which overhead ground wires are not used

5 **SPECIAL STUB ARMS** add impulse insulation of the pole to that of the crossarm to give a total flashover level over wood equal to that of the conductor to down-lead through air. This arrangement and Fig 6 probably represent the most thorough studies yet made

Shows Need of Design Check

for capacity increases.

No attempt was made in this survey to determine what percentage of lines are now operated with overhead ground wires. The question referred to present and expected future practice, since this would indicate the conclusion which has been reached after experience and studies of each system, usually with lines operated with and without this protection.

On the basis of this tabulation of present plans, it appears that about two-thirds of the 34.5-46 kv class lines to be built in the next few years will have overhead ground wires and one-third will be built without ground wire. This includes the older lines to be rebuilt. Only one company included in the survey is using or plans to use protector tubes for this voltage class line. There was more indication of starting or increasing the use of ground wires than there was in the direction of discontinuing or decreasing their use.

Many Variations in Spacings

The most extensively used 34.5-46-kv construction includes two arms and pole-mounted ground wire support, as shown in Fig 1. Arm lengths vary from 6 ft to 10 ft, spaced from 4 ft 6 in. to 6 ft 0 in., and with a similar range of dimensions from the top arm to the pole-top. An increase in the clearance between the grounding down-lead and top conductor is obtained by one company with the simple change shown in Fig 2. Considerable reduction in conductor spacing results in the single-arm construction of one design, Fig 3.

Simplest and most economical construction is possible, of course, without overhead ground wires. A single arm, 8 ft or 10 ft, and a pole ridge bracket are most commonly used, as shown in Fig 4. Single-arm arrangement of the three conductors, as in Fig 3 but without the ground wire, is rarely used for 34.5 kv.

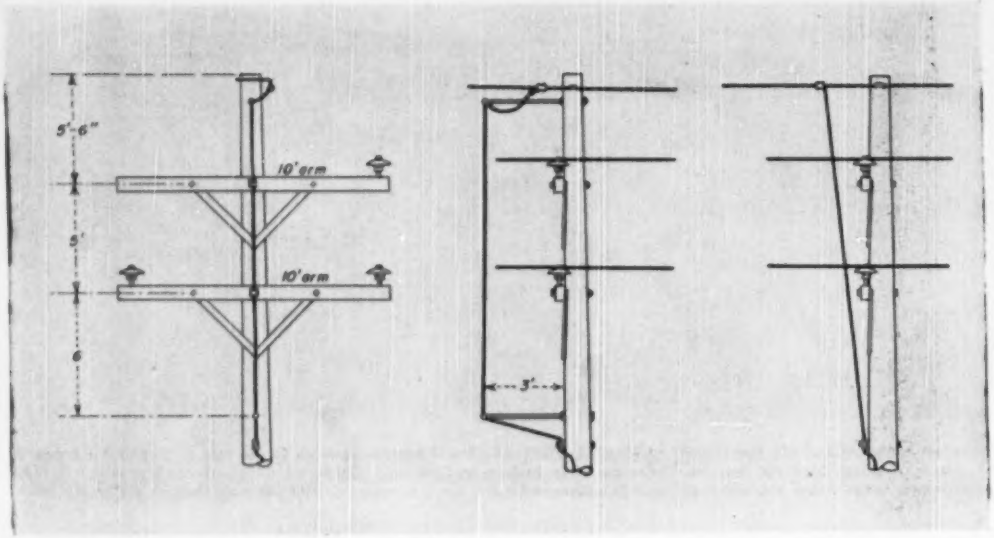
Probably the most thorough studies of design requirements for coordination of impulse insulation strengths are represented in the two arrangements shown in Fig 5 and 6. Insulation value of the pole is added to that of the crossarm to give a total flashover level over wood equal to that of the conductor to down-lead through air.

Another arrangement, as used by one company to obtain this additional clearance is shown in the side view of Fig 7. This introduces a serious possibility, however, of fatigue failure at the point of clamping and support of the down-lead, even with only occasional vibration of the ground wire span during many years of operation.

For and Against Ground Wires

Several extensive experience records show that practical immunity from lighting is possible with the use of an overhead ground wire on 34.5-46-kv transmission lines. An outage expectancy as low as one or two tripouts per 100 miles per yr is indicated with careful coordination of insulation and clearances and with low grounding resistances. A higher value of outages as the design base may also give adequate protection, including no damage due to flashovers, for the distances involved at this voltage. This view appears to be replacing the opinion which has been expressed, that clearances for these lower voltages are such that the use of ground wire is questionable.

On the other hand, even though 40 or 50 tripouts per 100 miles per yr may be expected on a line without ground wire protection, the cost of this installation may not be justified if two lines or other means of provid-



6 **BETTER APPEARANCE** is obtained with the brackets, at the same time adding impulse insulation to that of the crossarm, by utilizing the arrangement depicted above

7 **POSSIBLE VIBRATION** fatigue is an objection to using the clamp support

ing over-all continuity of service are provided.

In some cases, practical grounding resistances are so high that the value of an overhead ground wire may be questionable. Usually, however, an economic comparison can be made between effective protection and the costs for duplicate facilities and for added maintenance due to frequent operation of the switching equipment. Opinions have been found to differ on these questions within company organizations as well as between neighboring companies.

Perhaps the only general conclusion which may be drawn is: *If an overhead ground wire installation is justified, the small increment cost of a fully coordinated design with reasonably high impulse level is also justified.*

Need Review of Designs

A majority of the 34.5-46-kv structure layouts in use today have been used for many years. The trend toward application of ground wires noted in this survey is toward the use of standard drawings which have included ground wires, as in Fig 1, to replace construction of the Fig 4 type. Designs such as indicated in Fig 5 and 6 are in exceptional rather than general use, but their operating records are now sufficient to justify confidence in their extension.

A review may be desirable to check the adequacy of the older designs of wood-pole pin-type insulator construction in the light of information which is now available. The concepts on which a coordinated design may be based are of relatively recent origin compared to the information for higher voltage construction. Discussions during this survey indicate, however, that there is some confusion regarding the method and the application of these factors in the lower voltage design problem.

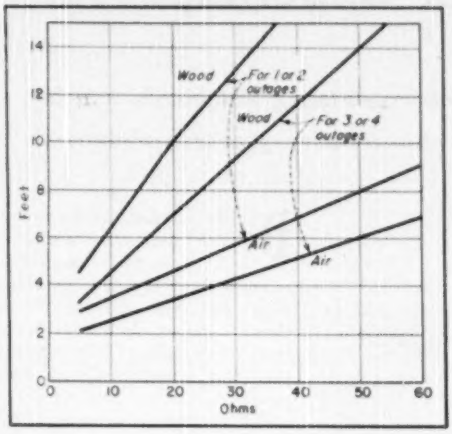
The most widely used method for estimating line performance is based on variations in the number of suspension insulators (1). Other insulation must be converted to this base, and further correction factors are necessary for application to the conditions of spacing, coupling and insulating medium associated with the lower voltage construction (2). The method outlined by Bewley (3) permits more detailed calculation of the design factors, but the complications do not appear to be justified for the relatively narrow limits of variation possible on wood arm and pole line construction.

The fundamental problem is to arrive at minimum air gap and wood path dimensions which will give an approximate balance in withstanding flashover voltages for the grounding resistance expected or possible to obtain. Lightning current values on the line, the probability of different currents and the effect of resistance are clearly established as major factors in the solution. Interrelated factors for the effects of coupling, span length, wire size, etc, are known with less certainty and, by comparison, they are not principal indices. They cannot be neglected but the variables may be combined into one average design factor for the practical conditions of this solution.

Minimum dimensions of air and wood are shown on the accompanying chart, plotted to a base of measured grounding resistance and for two levels of estimated performance in terms of outages per 100 miles per year. Voltages were calculated as the product of lightning current, effective resistance and an average design factor of 0.6. A slightly different set of values was obtained from the estimating curves of reference (2), and the final curves represent the influence of both sources of information. The resulting dimensions are based on an insulating value of 200 kv per ft for air and a conservative value of 65 kv per ft for wood. A flashover value

This Chart Determines Minimum Length of Air and Wood Paths

Minimum dimensions of air and wood paths may be estimated directly from this chart, for any value of measured grounding resistance and for the desired performance (outages per 100 miles per year in areas averaging 50 storm days per year). It is possible to make . . .



FIVE COMPARISONS:

1. Construction of the type shown in Fig 1, with 6 ft upper and 8 ft lower arms, gives about 3 ft of air and wood paths, which is in the range of satisfactory performance only with grounding resistance of 5 ohms or less.

2. Use of two 10-ft arms increases the permissible resistance to about 12 ohms.

3. Support of the grounding down-lead as in Fig 2 is an alternative to the longer top arm, but it does not improve the outage expectancy or increase the permissible resistance over that of two 10-ft arms. (Other studies have shown only a slight decrease in shielding efficiency with the angle increased as with the longer arm.)

4. Increasing the wood path to the down-lead at the lower arm level, as in Fig 5, permits resistance up to 27 ohms for 3 or 4 outage performance, or an improvement in expectancy to 1 or 2 outages per 100 miles per year with 15-ohm grounding.

5. Some additional insulation on the pole, obtained as in Fig 6, gives performance levels comparable to the design of Fig 5, with about 5 ohms higher grounding.

of 200 kv is used for the insulator in series with the wood.

Must Include Pole Insulation

This simplification is suggested only as the approach to a coordinated design for the usual conditions of 34.5-46-kv line construction. Closer estimating is desirable for checking each of the final dimensions of the configuration to be used. Plotting the principal factors on one chart is most useful for making comparisons and for evaluating the effects of changes which may be considered.

This and other studies of wood pole and crossarm design for 34.5-46-kv construction appear to justify these general conclusions:

1. Additional wood path along the pole is a necessity for coordination of flashover values, regardless of the resistance of grounding. Flashover through air rather than over wood requires a ratio of about one to two in the dimensions of the two paths for the usual types of construction.

2. Adding 1 ft of air gap and 2 ft of wood is the equivalent of reducing resistance 10 ohms.

3. Possible benefits of the overhead ground wire are always reduced and may be nullified by shunting out wood pole insulation by the grounding down-lead.

4. Wood insulation of the pole path may be economically provided. Certain minimum conductor separations are necessary to insure against midspan troubles under ice and wind conditions. The combination of these two factors with suitable grounding resistances can result in practical immunity from lightning outages for the usual line distances of 34.5-46-kv transmission. Good operation depends upon proper design and coordination of the pole-top assembly.

References:

(1) Line Design Based upon Direct Strokes, A. C. Monteith, *Electrical Transmission and Distribution Reference Book 1942*, page 325.

(2) Transmission Line Design and Performance Based on Direct Lightning Strokes, E. L. Harder and J. M. Clayton, AIEE Winter Meeting, Jan. 1949.

(3) Flashovers on Transmission Lines, L. V. Bewley, *AIEE Transactions*, Vol 55, 1936, page 345.

• • •

Non-Metered Mailing Speeds Handling of Bills

By use of a non-metered mail permit, it is not necessary to process the bills through the postage meter mailing machine.

Customers' bills are mailed, by The Dayton Power and Light Co, under a non-metered mail permit without postage stamps affixed. The required permit indicia is printed on the address side of the customers' bills at the time the bill form is printed on company-owned equipment. The indicia shows the permit number, transient rate of postage and point of mailing.

Amount of postage covering each day's mailing is determined by weight, 180 bills (postal card) weight one pound. Each day's mailing is accompanied by a Statement of Mailing of Non-Metered Matter (U. S. Postal Form No. 3602), showing number of bills mailed and the total amount of postage which is charged to the postage fund established for that purpose.—A. E. Gerlaugh, Supervisor of Customers Accounting

Indoor Substation Is One Third Smaller With Transfer Gear Superimposed

Comparative costs of outdoor and indoor substation designs show light savings in favor of indoor design with transfer gear superimposed

S. F. JOYCE, Jr.
Electrical Engineer
Union Electric Company of Missouri
St. Louis

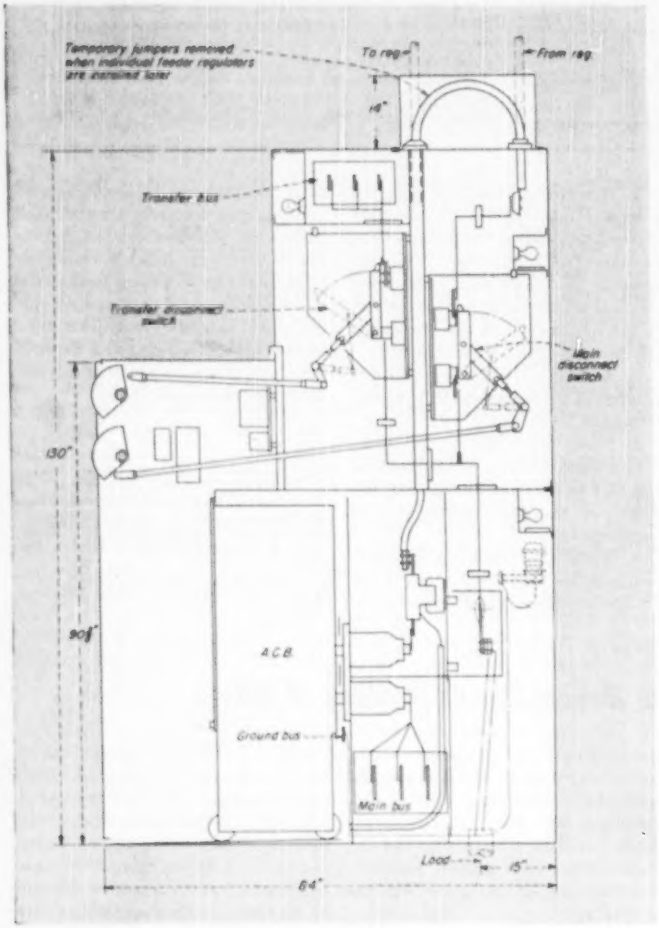


FIG 1—TRANSFER GEAR superimposed on feeder position, as shown, reduced cost of indoor substation by cutting area required by 496 sq ft, amounting to 30.8% less space

DESIGN comparisons for two projected substations, required for the St. Louis system in 1950, one to supply an estimated initial load of 9,300 kva, the other 18,000 kva, showed indoor design 3-4% less costly than outdoor where transfer gear was superimposed on feeder positions to reduce building size.

Both substations are to be supplied by 34.5-kv underground subtransmission cables and will distribute at 4,160 v, also underground. One substation, will have an initial installation of two 34.5-4.1-kv, 10,000/13,333-kva transformers with provision for a third transformer. The other will be provided with similar transformers initially. The 4,160-v circuits are being designed to carry loads of 400 to 450 amp normal and 600 amp maximum. Initial loads at the substations will require five and seven feeders respectively. Operating procedures require a transfer bus to take out of service any 4,160-v feeder position regardless of load conditions, thus facilitating maintenance work.

Study Basic Designs

Two basic designs were considered for each of the proposed installations. One was the unit substation type. The other was an arrangement with transformers placed outdoors and with switchgear located in a suitable building, using indoor metalclad switchgear. The latter arrangement offers advantages in lower operating and maintenance costs because, it will permit maintenance work on switchgear and controls regardless of weather conditions. Cost estimates were prepared for each design.

Early studies were based on use of transfer gear in separate cubicles. They indicated that considerable

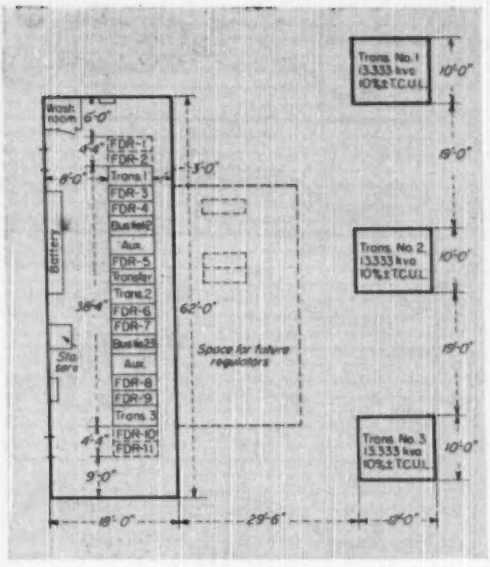


FIG 2—SEPARATE TRANSFER gear for 4,160-v feeders would have required a substation building 26 ft wide and 62 ft long

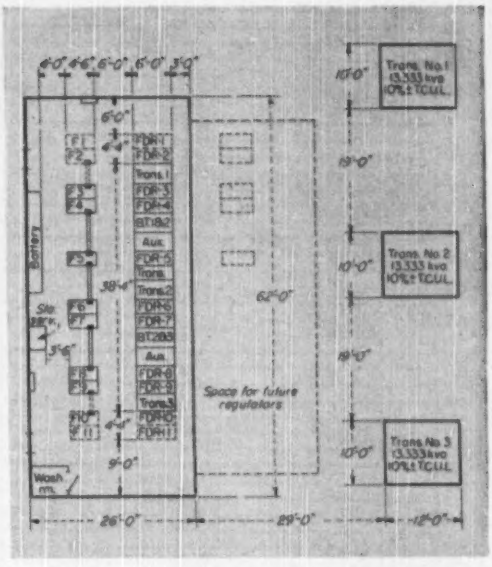


FIG 3—BY SUPERIMPOSING transfer gear on switchgear, building width could be reduced to 18 ft. Length remained at 62 ft

economy in building and other costs would result if the transfer gear could be combined with the main switchgear into one set of cubicles. Several manufacturers submitted designs which placed the transfer bus with its disconnects and other equipment in the same cubicles as the main switchgear. That arrangement increased the depth of the latter by 8 to 10 in. and height by 22 in. Manufacture of the gear in this manner would not add to its cost but, at the time the design and quotations were submitted, it was not available in outdoor gear in time to suit our needs. General arrangement of one of these indoor designs is shown.

Indoor Design Costs Less

Cost studies to determine relative economics were made for three schemes for each substation:

Scheme I—Outdoor unit substation type of equipment with a small building for toilet facilities, battery, etc. All switchgear and control panels to be in outdoor cubicles and transfer gear to be in separate cubicles.

Scheme II—Transformers - outdoors. Metalclad switchgear, transfer bus, battery, toilet facilities, etc, indoors. Transfer gear in separate cubicles.

Scheme III—Same as Scheme II, except that transfer gear has been superimposed on main switchgear, reducing building width from 26 ft to 18 ft, a reduction of 30.8% in building area.

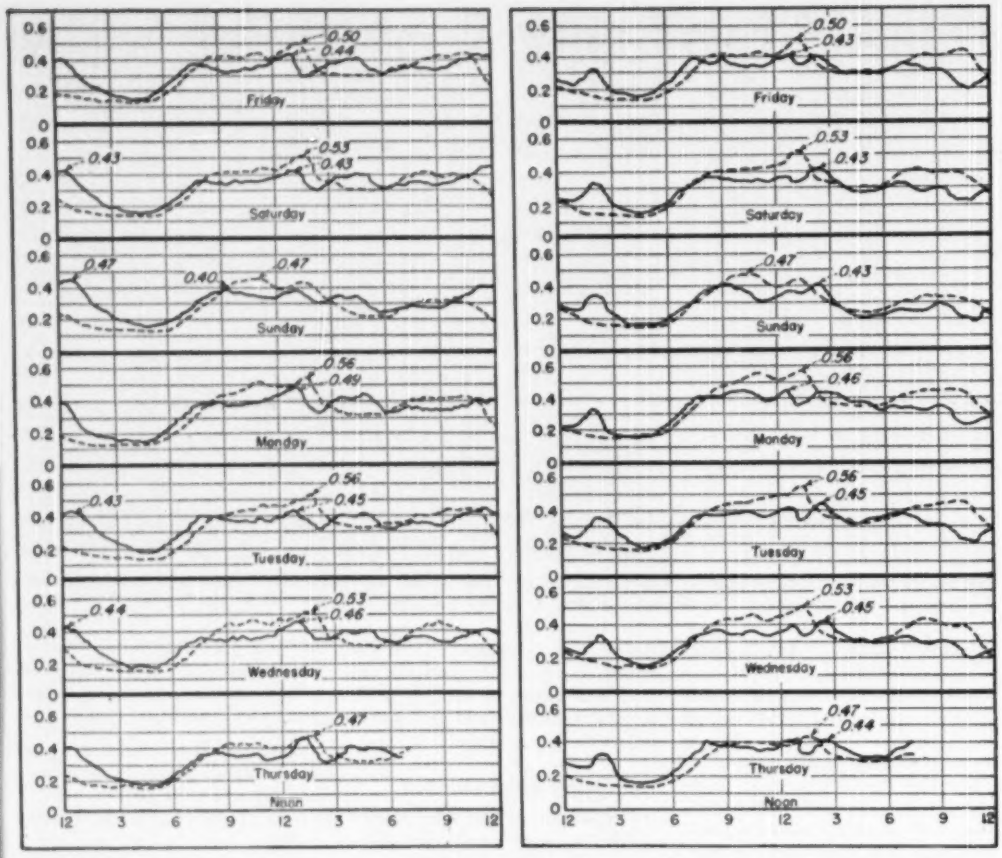
Accompanying outlines show ultimate arrangement for an installation with three transformers and the feeder positions to be initially omitted are indicated by broken lines. Ultimate arrangement for a two transformer substation will omit the third transformer and the 4-kv equipment on the bus section supplied from it.

Estimated costs of the three schemes for each substation are listed in the Table. On the basis of cost data, Scheme III was adopted. The estimated saving for this scheme over one using a unit substation is relatively small, but operation and maintenance with the switchgear in a building will afford an additional saving.

Estimated Costs

Item	Scheme I	Scheme II	Scheme III
TWO-TRANSFORMER SUBSTATION			
Building	$9,900	$30,900	$21,400
Site, grading and drive	19,100	16,300	15,100
Switchgear, transformers and regulators	$271,000	$256,600	$251,100
Foundations for equipment	5,000	2,700	2,700
Power cables and conduits	1,800	12,900	10,600
Battery and charger	2,400	2,400	2,400
Station meter and dc panel	3,850	3,850	3,850
Control wiring and conduits	2,750	2,750	2,200
Station lighting	2,200	1,650	1,300
Sewer and drains	1,650	1,650	1,650
Miscellaneous items	32,000	33,000	31,000
Total Estimated Cost	$351,250	$364,000	$343,300
THREE-TRANSFORMER SUBSTATION			
Building	$9,900	$44,600	$30,900
Site, grading and drive	21,200	19,300	17,700
Switchgear, transformer and regulators	408,300	382,300	376,800
Foundations for equipment	6,400	3,600	3,600
Power cables and conduits	11,700	19,100	15,100
Battery and charger	2,400	2,400	2,400
Station meter and dc panel	3,850	3,850	3,850
Control wiring and conduits	3,850	3,300	3,300
Station lighting	3,300	2,000	2,000
Sewers and drains	2,500	2,500	2,500
Miscellaneous items	47,000	48,000	46,000
Total Estimated Cost	$520,400	$530,950	$504,150

Note: Estimated costs include installation, engineering, drafting and supervision.



CONTROLLED OPERATION with 5 different time switch settings and unknown number of heaters on each setting for week beginning Friday, July 1, shown by solid line of left-hand graph. Solid line of right-hand graph shows controlled operation week of July 29 with ½ of heaters set for 10 PM—9:30 AM and ½ 12N—4 PM and 12M—6 AM. Dotted line on both graphs shows uncontrolled operation for week beginning July 15. Peak in uncontrolled operation occurred twice—Monday and Tuesday. Peak in controlled operation was reduced from reading of 0.49 on Monday, July 4, to 0.46 on Monday, Aug. 1, by revision of time switch settings

Controlled Water Heating Causes "Off-Peak" Peak

H. E. ANTLE, Boone County REMC, Lebanon, Ind.

Condition results from rapid post-war increase in number of heaters and variations in charging hours. No cure found in uncontrolled operation, but improvement comes from revision of charging periods

OFF-PEAK system peaks caused by water heaters in controlled operation were experienced by the Boone County Rural Electric Membership Corp, and REA co-operative, in May and June last year. These peaks, which set the billing demands for supply from the Indiana Public Service Co, were not wholly unexpected. The number of heaters

had been growing rapidly in the post-war years. Although all were equipped with off-peak control, the settings of the time switches were various and the situation was getting rather out of hand because managerial and other operational attention was occupied with much more pressing problems of post-war load growth and expansion of the system.

Census Shows 754 Heaters

When the peaks occurred, information concerning water heaters on the system was not complete. There were five different time-switch settings of control switches. The first step, therefore, in any attempt to cure the condition was to determine the number, sizes and time-switch settings of heaters. A census was taken. It showed 754 heaters in sizes from 30 to 90 gal, as detailed in the accompanying table. The system served 3,124 farm and other rural families. The water heater saturation was thus 24.23%.

In the survey, users were asked about adequacy of hot water supply. Out of 652 replies, only 14 consumers said they actually ran out of hot water, then only on washdays. There were 19 others who said they did not have enough hot water for their requirements. This meant that about 5% of consumers either were prodigal in use of hot water or their heaters were too small. Probably the latter, since the table shows about 67% of the heaters of 50 gal or less.

Uncontrolled Service Test

Since the peaks occurred under controlled service conditions, obviously it would be well to find out how the load would behave without control. A crew was sent out to block the time switches in the "on" position. They blocked 703, could not get in in 51 cases, folk not home. The 703 heaters operated uncontrolled for 10 days. During this period the power company waived the demand provision in the purchase contract, agreeing to bill on demand established under controlled service in the month.

Record for a week of uncontrolled operation is shown in dotted lines on the two graphs opposite. A peak of 2,076.5 kw was established in this week, about 1 PM on Monday, July 18. About the same value was reached at the same time the next day. The two "off-peak" peaks in May and June which started the investigation had occurred just before Saturday midnight—bath night. It is interesting to observe on the graphs that the Saturday night demand under uncontrolled operation is not particularly high.

Water Heaters on Boone County System

Sizes of Heaters, Gallons	No. of Heaters	Percent
30	40	5.31
40	24	3.18
50	438	58.09
60	69	9.15
70	4	.53
80	76	10.08
90	1	.01
No record	102	13.65
Totals	754	100.00

Peaks Before and After Test Period

In solid lines the graphs show controlled operation before and after the uncontrolled period. The "before" peak of 0.49 occurred about 1 PM on Monday, July 4, but the next highest demand, 0.47, was at about 1 AM Sunday, evidencing that the Saturday night requirement of hot water that caused the May and June peaks was still a large factor. The 5 switch settings previously mentioned were still in effect at this time —(1) 1 PM-4 PM and 10 PM-5 AM; (2) 2:15 PM-3:15 PM and 9 PM-5 AM; (3) 12 N-4:30 PM and 12 M-5:30 AM; (4) 9 PM-7 AM; (5) 8 PM-6 AM. The "after" record of controlled operation shows a peak of 0.46 on Monday, down from the "before" peak of 0.49. This result is ascribed to the change in time switch settings, ⅓ of them now 10 PM-9:30 AM and the remainder 12 N-4 PM and 12 M-6 AM.

All heaters on the system are 2-element, thermostat-controlled with interlock to prevent both elements being on at the same time. Energy to the bottom element is metered and billed at the water heater rate of 1¢ per kwhr. The top element is connected through the regular service meter. Because of the interlock between elements and of the fact that the top element is of no larger rating than the bottom one, it may not be conjectured that, except as to time, there was any difference in operation of the heaters to explain the higher demand under uncontrolled service. Nor was there any indication in the July billings of more than usual consumption of energy by the top elements of heaters.

The significance of the water heater demand on the Boone County system appears in comparisons of bills for energy purchased. The bill for the period, June 23-July 22 was $6,799.47. This was based on a demand of 1,816.9 kw which was established during the time of controlled operation in the month of July. The demand in the period of uncontrolled operation was 2,076.5 kw. This would have resulted in a bill of $7,292.71, about $500 higher than was paid. For the period July 22-Aug. 22, after the time switches on the heaters had been re-set, the demand was 1,705.7 kw and the bill $6,758.77.

Another aspect of the importance of the water heater demand was noted during the time of the test. Recording voltmeter charts from two points on the system showed that the average regulation while the heaters were operating uncontrolled exceeded that of before and after. For the 10 days of uncontrolled operation one chart showed 6.1% average regulation, but only 5.7% before and 4.3% after.

Conclusions

In the conditions and experience of the Boone County REMC system, the following conclusions appear justified by the results of the investigation:

1. Water heaters are peak power appliances. Uncontrolled, they contribute heavily to the system peak.

2. Properly set, and considering their investment and maintenance costs, electric time switches with spring carry-over are a satisfactory means of control up to 40% water heater saturation. Above that other means may be better.

3. Water heater control is effective in reducing cost of purchased electricity and helps to maintain satisfactory voltage regulation.

4. Constant checking of time settings and of clock operation is required for full realization of benefits of time-switch control.

5. A third time setting, 9 PM-9 AM, is indicated to improve control further. (This was done immediately after complete analysis of test data.)

"Automatic Relayman" Changes Breaker Settings

Switch scheme lets operator change relay settings for abnormal conditions without calling relayman

H. P. DUPUIS
Commonwealth Services, Inc, Jackson, Mich.
and
B. P. CARR
Consumers Power Co, Jackson, Mich.

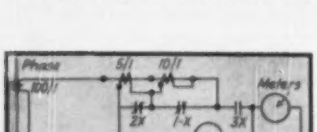


FIG 1—AUXILIARY current transformer secondaries are connected for switching relay current. A rotary switch controls 3 phases

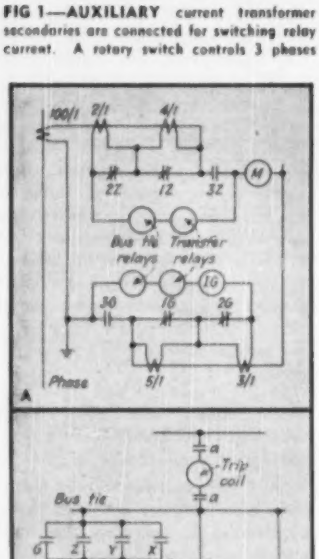


FIG 2—SELECTOR SWITCH changes effective settings of the relays (A), and also makes either bus tie or transfer relays inoperative by opening their trip circuits (B)

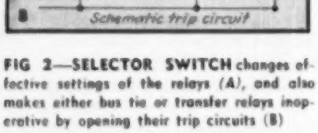


FIG 3—A TAPPED autotransformer may be used for the auxiliary current transformer

CIRCUIT BREAKERS associated with transfer bus connections often require changes in the relay settings, during temporary supply to an outgoing circuit, to correspond to the normal breaker relaying. Rotary switches with auxiliary current transformers have been used on the Consumers Power Company system as a quick and convenient way of making these changes. A quick transfer of settings, made by the station operator as he performs other switching operations, is made possible by this rotary switch scheme.

Auxiliary current transformers of the proper ratio to meet the requirements of the various circuits are connected as shown in Fig 1. Such a switching arrangement permits using any one of three different over-all ratios, having the effect of three current taps on the relays. The switching operation bypasses or shunts the auxiliary current transformers not in use, thus providing a path for the proper auxiliary secondary current through the relay. In some cases, contacts in the relay trip circuits are closed or opened to cut specific relays in or out of service. Since the ground relaying, where required, may differ considerably from the phase relaying, it is usually advisable to have a separate switch for ground relays.

The initial consideration is that the thermal limitations of the instruments in the main current transformer secondaries are not exceeded on the most heavily-loaded circuit. From the data, given in the table, a 100/1 ratio for the main current transformer can be used on the transfer breaker and allow ample thermal margin for overload when used on the transformer. A 100/1 ratio would require a 1.0 amp tap on the relay to give a 100 amp primary pickup on the long line. With the relay set on the 1.0 amp tap, using a 5/1 auxiliary current transformer when transferring the short line would give a primary pickup of 500 amp, and a 10/1 auxiliary transformer would give a primary pickup of 1,000 amp when used in transformer position.

Typical Normal Relay Settings

Circuit	Main CT Ratio	Full Load Sec Amps	Relay Current Tap	Relay Pickup Pri Amps
Transformers	120/1	3.3	8	960
Short Lines	60/1	4.0	8	480
Long Lines	20/1	3.0	5	100

These values are nearly the same as the normal settings shown below. However, with the relays set on a low current tap, it may be well to use low energy relays to avoid excessive burden on current transformers.

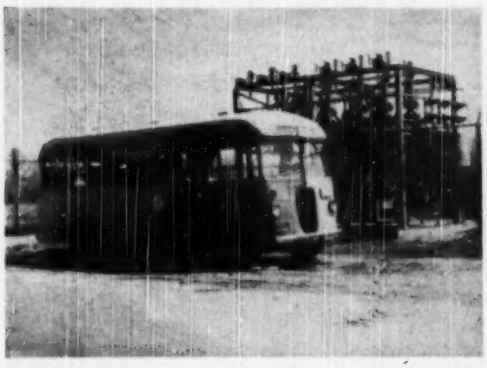
The current tap and suitable range of auxiliary transformers used with the ground relay can be obtained in a somewhat similar manner by tabulating the primary ampere pickup of the ground relays on the various circuits. A current tap is selected with ratios to approximately match these values, taking into consideration that the ratio of the main current transformers has been determined by the phase relay requirements.

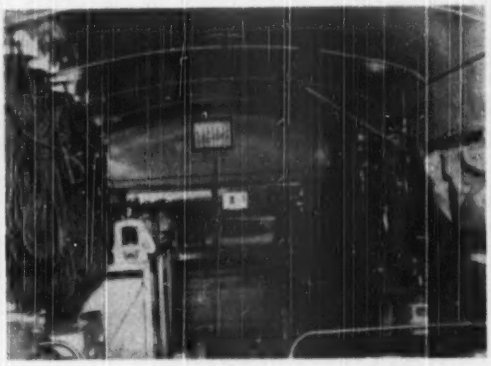
An additional set of phase and ground relays may be required when bus connections provide that the same breaker may be used either for load transfer purposes or to sectionalize the bus. The two sets of relays can be cut in or out of service by shunting the current coils, but it is simpler and requires fewer switch contacts to control the trip circuits of the relays as shown in Fig 2.

Similarly, instantaneous relays or instantaneous attachments can be cut in or out of service as desired, or any zone of a step type relay can be made inoperative. Directional relays can be made nondirectional by bringing the directional contacts out of the relay case and connecting them to contacts on the switch.

If the desired ratio of auxiliary current transformers can be obtained with a tapped autotransformer, the switching connections can be made similar to Fig 3.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN





TRAVELING WORKSHOP is a converted passenger bus (left) equipped with tools (right) for performing work on rural substations

Substation Workshops on Wheels

JOHN C. ANDERSON
Columbus & Southern Ohio Electric Co
Columbus

TWO BUSES, formerly used for passenger transportation, were rearranged and equipped as "workshops on wheels". Object of conversion is to bring all necessary tools and equipment to the job at one time and to assure a continuous flow of work under all weather conditions, especially at rural substations where there are no buildings for protection. The newly equipped workshops are also effective when a new project is starting and there is no building or place to store tools. Aside from working equipment, there is a drinking water cooler and 5-kw light plant.

One mobile unit is a construction shop while the other is for maintenance work. Both units seat nine people, including the driver.

• • •

Tables Simplify Series Street Light Computations

CHARLES C. HOKE
Engineer
Union Electric Co of Missouri
St. Louis

TWO TABLES have been developed to simplify load calculation on 6.6-amp series street light transformers and to facilitate keeping load records. Table 1 lists wattages in the transformer, line, lamp, secondary loads, and primary loads for lamps of 40 to 600 cp (400 to 6,000 lumen output) on both overhead and underground construction. Table 2 is a load record for a typical circuit and when posted on the street light circuit map shows the loading of the constant current transformer involved at that time.

In practice, when it is necessary to

Table 1. STREET LIGHT LOADS

Lamp		Watts used in Line (*)			Secondary Load, Watts	Primary Load, Watts
CP	Lumens	Transformer (*)		Lamp		
		OVERHEAD CIRCUITS				
40	400	2.11	12.87	33.0	45.87	47.98
60	600	2.60	12.87	43.6	56.47	59.07
80	800	3.08	12.87	54.1	66.97	70.05
100	1000	3.43	12.87	61.7	74.57	78.00
250	2500	7.16	12.87	142.9	155.77	162.93
400	4000	10.27	12.87	210.5	223.37	233.64
600	6000	14.83	12.87	309.3	322.17	337.00
		UNDERGROUND CIRCUITS				
40	400	1.91	8.57	33.0	41.57	43.48
60	600	2.40	8.57	43.6	52.17	54.57
80	800	2.88	8.57	54.1	62.67	65.35
100	1000	3.23	8.57	61.7	70.27	73.50
250	2500	6.97	8.57	142.9	151.47	158.44
400	4000	10.08	8.57	210.5	219.07	229.15
600	6000	14.60	8.57	309.3	317.87	332.47

(*) Transformer losses per series lamp are based on a 15-kw, 2,400-v primary to 6.6-amp secondary series lighting transformer fully loaded.
(*) Overhead line losses are based on an average spacing of 300 ft of No. 6 wire between lamps. Underground line crosses are based on an average of 200 ft of No. 6 circuit per lamp.

determine whether a transformer has available capacity for the proposed new additions, multiply the number of lamps of each size by the "secondary load in watts" as found in Table 1. If the sum of these multiplications is less than the rating of the transformer, the additional load may be applied. If the sum is greater than the transformer rating, one of three courses should be followed:

1. Replace constant current transformer with one of larger rating.

2. Split the series circuit into two circuits, each having its own constant current transformer. This is the preferred alternative if it is desirable to limit the open circuit voltage to existing values.

3. Transfer part of the series circuit to an adjoining street lighting circuit having available capacity. This is the desirable alternative if it is necessary to hold down the number of constant current transformers and switching points involved.

Table 2. TYPICAL LOAD COUNT

Lamps, CP	Kw per Lamp	No. of Lamps	Load, Kw
600	0.322	.....	.....
400	0.223	4	0.892
250	0.156	19	2.964
100	0.075	55	4.125
80	0.067	.....	.....
60	0.056	.....	.....
Total	.....	78	7.981

To estimate the kilowatthours used on a series circuit, multiply the number of lamps of each size by the "Primary Load in Watts" (Table 1). The sum of these multiplications should then be multiplied by the number of hours the street lights are on. This figure is the watthour consumption in the circuit and is converted into kilowatthours by moving the decimal point three places to the left.

Data for other conditions may be obtained as follows: (1) For different circuit lengths per lamp, the line watts can be multiplied by the ratio of the actual average lamp spacing to the basic spacings given. (2) For different wire or cable sizes the line watts can be multiplied by the ratio of the impedance for any length of the actual cable to the impedance of the same length of the wire or cable given in the table.

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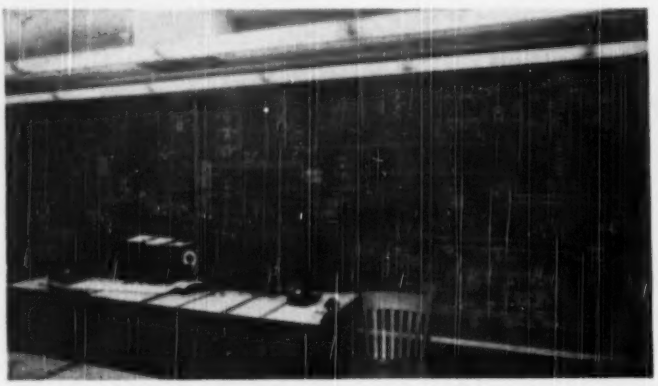


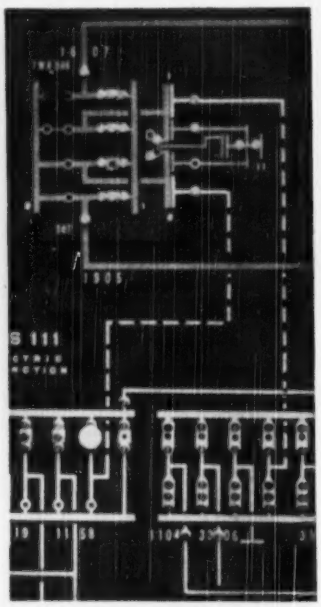
OPERATING BOARD at Wheaton shows generating, transmission and distribution facilities in the Wheaton zone and adjacent territories

Operating Diagram Taped to Perforated Linoleum Board

MAINTENANCE of an accurate operating diagram has been simplified by installation of a new operating board in the Power Supervision office of Public Service Co of Northern Illinois at Wheaton, Ill. The new board incorporates several novel features. Besides being easy to keep up-to-date it is neat in appearance and diagram changes can be made without the messiness of past methods.

The new board is made of $\frac{1}{4}$-in. thick green linoleum which was purchased in three-foot widths and perforated by a Chicago fabricating firm with $\frac{1}{16}$-in. holes on $\frac{3}{32}$-in. centers and unstaggered on horizontal and vertical rows. Perforations covered the entire area, and the linoleum was mounted on a $\frac{3}{4}$-in. plywood frame.

Transmission lines were represented by cellulose tape of appropriate colors to designate the various voltages. Symbols represent switching devices such as circuit breakers, disconnecting switches and air break switches. Open or closed positions are indicated by presence or absence of a metal pin in a hole centered on the switching device symbol. Metal



PERFORATIONS in the board, simplify placing of symbols for switches and circuit breakers as well as cellulose tape representing circuits

pins, with appropriate heads, are inserted to indicate equipment removed from service and held for work, ground disconnects closed, circuit breakers or disconnects normally open or any other condition which may exist.

This type of board requires a minimum of time and skill to install, be-

PRACTICALLY NOTHING TO MAINTAIN

...not even the Oil!

General Electric's present-day Induction-type Feeder Voltage Regulator comes as close to being maintenance-free as any electrical equipment with moving parts.

And—these regulators give accurate, stepless regulation, with no time-delay. They respond immediately to voltage changes and will provide correction at an average rate of one per cent in 1½ seconds throughout the entire range of ± 10 per cent regulation.

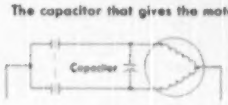
Bulletin GEA-2985C gives a full description of this induction regulator—of its basic design which has been standard for ten years, and of the refinements, particularly in control-panel arrangement, which have recently been incorporated at the suggestion of users. A copy is yours for the asking. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

FEWER PARTS TO WEAR
FEWER PARTS TO MAINTAIN

The General Electric IRS Induction Regulator has only three shafts (including the motor) . . . all mounted in roller or ball bearings, all operating under oil.

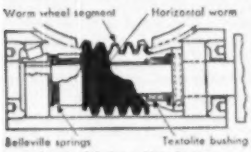
SIMPLE DYNAMIC BRAKING

The capacitor that gives the motor its high starting torque automatically provides strong braking action when the motor supply circuit is opened. No separate braking circuits are needed because the capacitor is permanently connected across the motor terminals. There are no mechanical devices to adjust.



NON-CHATTERING LONG-WEARING GEARS

One gear train, a double-worm reduction, provides a drive which is simple, silent, self-locking and positive. There are no ratchets, no pawls, no chains to introduce uncertain operation and questionable life.



Details of Spring-cushioned Worm

SEALED TANK PROLONGS OIL LIFE

Since there are no switching contacts in the IRS regulator, designers were free to seal the tank completely. By doing this, they sealed out atmospheric air, moisture and other contaminants. The life of the insulating oil—and consequently the regulator—is greatly prolonged.

GENERAL ELECTRIC

cause horizontal and vertical rows of perforations make it easy to line up transmission lines, with cellulose tape symbols, and insert the metal pins designating breakers and switches.

Likewise, revisions are made easily by pulling metal pins from the perforations and removing tape and placing new tape and pins in the proper places. Again the rows of perforations facilitate lining up both switches and transmission lines. This procedure allows no disfiguring marks to remain on the board where old equipment has been removed.

A similar operating diagram board, using masonite instead of linoleum, has been installed in the Power Supervision office at Joliet, Illinois. Perforations were equally satisfactory on this material.

Resistor-Shunt Checks Field-Temperature Records

II—Construction and Connections

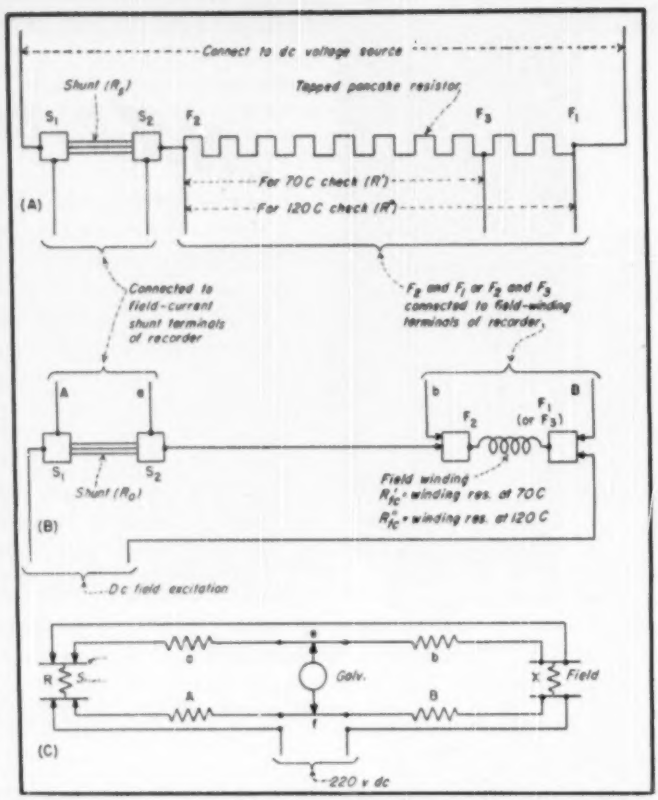
M. A. STECKEL
System Meter Supt
Appalachian Electric Power Co
Charleston, W. Va.

A TESTING DEVICE was developed to check readings of field-temperature recorders on generators and synchronous condensers. This combined unit consists of a tapped pancake resistor and a current shunt in a ventilated enclosing case. See ELECTRICAL WORLD Feb 13, 1950, page 96.)

The pancake resistor coil (A) substitutes for the field winding. It is constructed so its overall resistance (F_2F_1) and that of the tapped section (F_2F_3) are proportional to the field winding resistances at 120 C (or 125 C in case of generators) and 70 C respectively. As constructed the coil is approximately 5 in. in diameter, 1 in. wide and required about 1 lb of enameled No. 20 Advance resistance wire. Each concentric layer is separated from the adjacent layers by eight ¼ x ¼ x 1¼-in. fiber blocks placed on the circumference.

The reference current shunt R_s substitutes for the normal field-current shunt R_o and is permanently connected in series with the pancake resistor. The ratios of the shunt resistance to that of the F_1F_2 and F_2F_3 sections of the pancake coil are the same as the ratios of the field-current shunt resistance to the field-winding resistance at 120 C (or 125 C) and 70 C respectively. The shunt R_s is approximately 4 in. long and is also made of No. 20 (or larger) Advance resistance wire, soldered into brass terminals. For facility in calibrating the test device, the shunt should initially have slightly more than the required cross section.

After the checking device is assembled, it is calibrated by impressing 130 v across the F_1S_1 terminals. The potential drops across the F_1F_2 and F_2F_3 sections of the resistor should be checked to see that $R_s/R' = R_o/R'_{fc}$ and $R_s/R'' = R_o/R''_{fc}$ (see diagram B). If the ratios do not check, the tap F_2 can be moved slightly in either direction.



SCHEMATIC CONNECTIONS of (A) temperature recorder checking device, (B) terminals of field temperature recorder, and (C) equivalent bridge circuit of recorder. Balance of the recorder is obtained when the ratio of the bridge resistance arms satisfies the following relations $X/R = B/A = b/a$. R is fixed and X varies as temperature of field winding. Bridge is balanced by changing value of slidewires e and f. Travel of the slidewires is recorded on a chart as the field temperature of the tested generators or synchronous condensers

The same material should be used in both the shunt and resistance coil to minimize temperature errors. A set of test leads and a diagram of proper connections are provided with each test device.

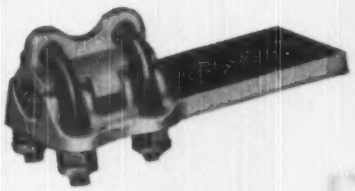
(Continued on page 106)

GENERAL ELECTRIC CONNECTORS

will carry the full-load current of EITHER cable, tubing or rod

SIMPLIFY YOUR INVENTORY

Only ONE G-E power connector is needed for any one size of conductor used—cable, tube or rod. This alone reduces your inventory—and saves you money—because there's no need to stock different connectors for every type of conductor.

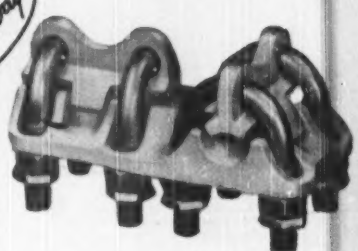


Disconnecting Switch Connector

FEWER CONNECTORS NEEDED

General Electric connectors will handle a greater range of conductor sizes. For instance, five G-E terminal connectors (shown top, right) will handle ALL 22 conductor sizes between 1/0 and 1¼ IPS. How many different connectors do you have in stock to take care of this range of conductor sizes?

why not check this right away?



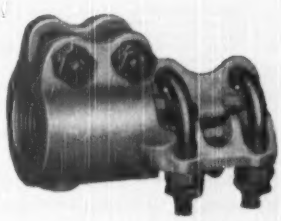
Station Tee Connector

SIMPLIFY ORDERING PROCEDURES

Each G-E connector has only one catalog number—and one price—regardless of the type of conductor for which it will be used. (And neither will you find two catalog numbers—and two prices—assigned to the same connector just because one is listed for use with tubing and the other for use with cable.) This will reduce your connector costs and simplify your ordering procedures by making it unnecessary to order several ordinary connectors when one G-E connector will do the job.

SAVE ORDERING TIME

With fewer connectors to order, you can order in less time. And G-E connectors are easier to order, too, for the simple reason that you don't have to specify so many different varieties to do the job.



Power Breaker Connector

Place an order today with your G-E sales representative and start realizing the many benefits to be gained by using General Electric connectors. Also, write for a copy of bulletin GEC-400 that contains 40 pages of valuable information on G-E connectors and see for yourself how easy they are to order. Write to *Apparatus Department, Section 856-53, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

Lamps–Aerodrome and Airway Lighting IES-SAE Recommended Practice

Lamps shown are those recommended for the service indicated. This list is not intended to be a catalog and hence does not include many of the older types of lamps now in use

Lamps to be Used with Lighting Units for Various Services

Line No.	Service	Volts or Amp	Watts or Lumens	Bulb	Base	Filament	Light Center Length, in.	Maximum Over-all Length, in.	Approx. Lumens	Rated Average Laboratory Life, hr(†)
1	Runway, Threshold, High Intensity	6.6 A	200 W	T-14	Med. Pref.	C-13	2-3/16	5-3/4	4,800	75
2	Runway, Threshold, High Intensity	115 V(*)	500 W	T-20	Med. Pref.	C-13D	2-3/16	5-3/4	13,000	25
3	Approach, High Intensity	12.5 V	250 W	PAR-56	2 Contact Lugs	C-6		5-1/4		100
4	Approach, High Intensity	115 V	400 W	PAR-56	2 Contact Lugs	CC-13		5-1/4		100
5	Approach, High Intensity	115 V(*)	5000 W	T-64	Mog. Bipost	C-13	6-1/2	13-3/8	164,000	75
6	Elevated Strip, Runway, Threshold, Taxiway	6.6 A	30 W	T-10	Med. Pref.	C-2V	1-1/2	3-15/16	450	1,000
7	Elevated Strip, Runway, Threshold, Taxiway	115 V(*)	40 W	T-10	Med. Pref.	CC-2V	1-1/2	3-15/16	495	1,000
8	Elevated Strip, Runway, Threshold, Taxiway	6.6 A	45 W	T-10	Med. Pref.	C-2V	1-1/2	3-15/16	740	1,000
9	Elevated Strip, Runway, Threshold, Taxiway	115 V(*)	100 W	T-10	Med. Pref.	CC-2V	1-1/2	3-15/16	1,225	1,000
10	Boundary [4], Wind Tee	115 V(*)	25 W	A-19	Med. Sc.	C-9	2-1/2	3-15/16	260	1,000
11	Obstruction [5]	115 V(*)(†)	50 W	A-19	Med. Sc.	C-9	2-1/2	3-15/16	550	1,000
12	Obstruction [6]	115 V(*)	67 W	A-21	Med. Sc.	C-9	2-7/16	4-7/16	685	3,000
13	Obstruction [5]	115 V(*)	111 W	A-21	Med. Sc.	C-9	2-7/16	4-7/16	1,300	3,000
14	Runway (Low Intensity), Boundary, Taxiway	115 V(*)	40 W	A-21	Med. Pref.	CC-2V	2-3/4	5-5/16	370	2,000
15	Runway (Low Intensity), Boundary, Taxiway	6.6 A	325 L	A-21	Med. Pref.	C-8	2-3/4	5-5/16	320	2,000
16	Range, Runway, Threshold (Low Intensity)	115 V(*)	100 W	A-21	Med. Pref.	CC-2V	2-3/4	5-5/16	1,170	2,000
17	Range, Runway, Threshold (Low Intensity)	6.6 A	1020 L	A-21	Med. Pref.	C-8	2-3/4	5-5/16	1,000	2,000
18	Beacon (Aerodrome, Airway, Hazard, Landmark)	30 V	500 W	T-20	Med. Bipost	C-13B	3	7-1/2	10,000	500
19	Beacon (Aerodrome, Airway, Hazard, Landmark)	30 V	1000 W	T-20	Mog. Bipost	C-13	4	9-1/2	25,500	500
20	Beacon (Aerodrome, Airway, Hazard, Landmark)	115 V(*)	1000 W	T-20	Mog. Bipost	C-13	4	9-1/2	20,500	500
21	Beacon (Aerodrome, Airway, Course Light, Hazard, Landmark)	115 V(*)	500 W	T-20	Med. Bipost	C-13B	3	7-1/2	9,250	500
22	Beacon (Aerodrome) [5]	6 V	100 W	PAR-56	Sc. Term.	C-6		4-1/2		500
23	Beacon (Obstruction Marker)	115 V(*)	230 W	PS-30	Mog. Pref.	C-9	5-1/16	8-3/4	3,600	3,000
24	Beacon (Identification, Obstruction Marker)	115 V(*)	620 W	PS-40	Mog. Pref.	C-7A	5-11/16	10-1/16	10,800	3,000
25	Floodlight (Landing Area or Runway)	32 V	1500 W	T-24	Mog. Bipost	C-13B	4	10-1/2	42,000	100
26	Floodlight (Landing Area or Runway)	32 V	3000 W	T-32	Mog. Bipost	C-13B	5-3/4	14	88,500	100
27	Ceiling Projector	12 V	420 W	G-25	Mog. Pref.	C-2V	1-11/16	5-3/16	10,500	100
28	Ceiling Projector	(8)	900 W	T-12	Sleeve			3-1/4(7)	65,000	
29	Landing Direction Indicator (Tetrahedron)	115 V(*)	10 W	S-14	Med. Sc.	C-9	2-1/2	3-1/2	79	1,500
30	Air Traffic Signal	6 V	50 W	T-8	D. C. Pref.	C-2V	1-1/4	3-1/8		50
31	Air Traffic Signal	110 V	99 W	T-8	D. C. Pref.	CC-13B	1-1/4	3-1/8	1,800	50
32	Channel (Water)	(1)	6 W(Green)	T-5	Min. Bipin			9		
33	Channel (Water)	(1)	15 W(Green)	T-8	Med. Bipin			18	900	
34	Channel Threshold (Water)	(1)	6 W(Gold)	T-5	Min. Bipin			9		
35	Channel Threshold (Water)	(1)	15 W(Gold)	T-8	Med. Bipin			18	375	

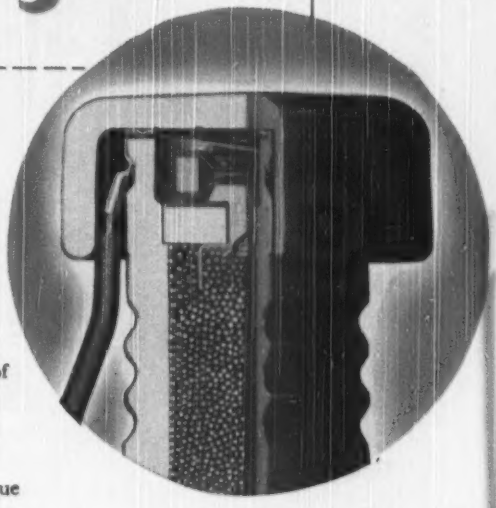
(†) Fluorescent lamp to be used with auxiliary of proper design.
(*) Vibration Service Lamp. Operating position base up or base down only.
(†) Under specified test conditions.
(4) Recommended for use on airports having non-scheduled operations.
(5) Recommended for use on airports having scheduled operations.
(6) Where necessary, 120- or 125-v lamps are available.
(7) Nominal length.
(8) Air cooled, high pressure mercury lamp to be used with auxiliary of proper design.

D. C. = Double Contact.
Med. = Medium.
Mog. = Mogul.
Pref. = Prefocused.
Sc. = Screw.
Term. = Terminal.

Approved October 1949 by Illuminating Engineering Society and January 1950 by Society of Automotive Engineers.

Sealed-in Nitrogen

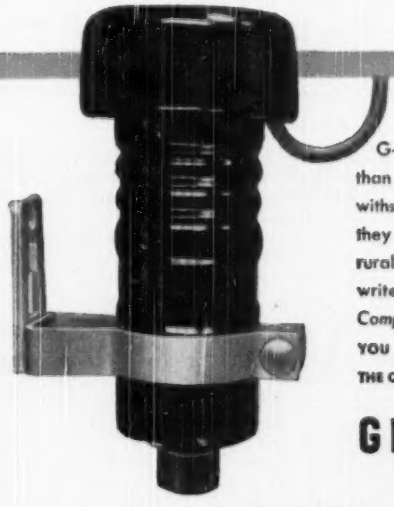
—one big reason why users prefer Pellet Arresters



Section of 3-kv pellet arrester, showing sealed N_2-filled gap chamber containing the series gap elements.

The G-E Pellet Arrester is the *only* distribution lightning arrester made today with dry nitrogen (N_2) sealed in the gap chamber. It's an *exclusive* G-E feature and your assurance of greater reliability over more years of operation. By preventing the formation of ozones and oxides, the dry, inert nitrogen keeps gap-electrodes bright as new and also stabilizes low sparkover characteristics.

G-E Pellet arresters are also distinguished by their unique valve material—lead dioxide pellets—which provides valve-action with *exceptionally low* IR drop—and which is unaffected by atmospheric moisture, condensation or humidity. These are reasons why the excellent protective characteristics of Pellet arresters *stay* excellent.



G-E Pellet Arresters limit lightning voltages to lower levels than any other distribution arrester—all ratings will easily withstand the AIEE-NEMA standard 65,000-ampere test—and they are applicable on *any* distribution system, urban or rural. For further details see your nearest G-E dealer or write for Bulletin GEA-2975. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

YOU BUY BETTER PROTECTION WHEN YOU BUY PELLET ARRESTERS!
THE QUALITY-STANDARD OF THE INDUSTRY FOR MORE THAN 25 YEARS

GENERAL ELECTRIC

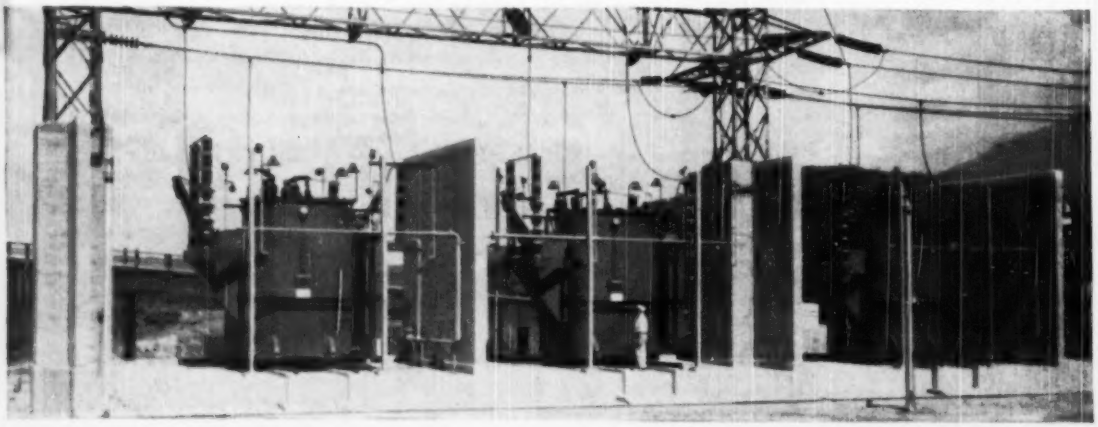
Confidence reduced the cost of this transformer 10%

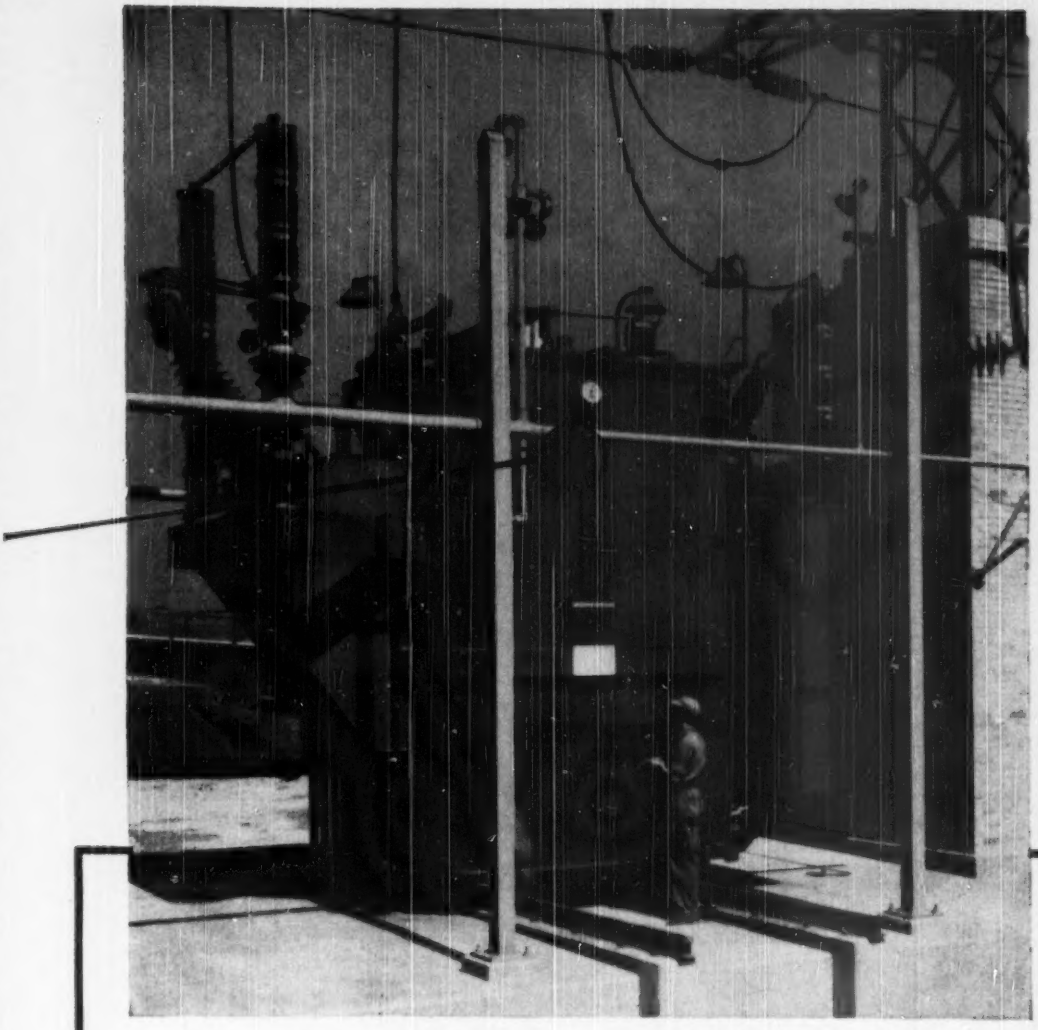
This transformer, and many others like it, stand as testimony to confidence in modern protective devices and research—explained on the opposite page. Because of this confidence, it is lighter in weight, smaller in size. Its losses are less, its impedance lower—and it saved its purchaser 10 per cent in price.

Because high-voltage research helps solve such practical problems as this, General Electric has recently built a new and better high-voltage laboratory at its Pittsfield, Massachusetts, plant where transformers are made. This laboratory is larger, permits more exacting tests on transformers and lightning arresters, and at voltages as high as 15 million volts. It is a research and engineering tool that will be used to its fullest capacity on future transformer design and development work.

Here is one more good reason why you can put your confidence in General Electric.

Apparatus Dept., General Electric Company, Schenectady 5, New York.





This transformer, a close-up of one of the three at the left is in service at the Tidd Station of The Ohio Power Company near Brilliant, Ohio. It operates at 138,000 volts, but is insulated in accordance with 115,000-volt insulation levels.

The story behind it goes back almost 20 years—to other transformers designed to specifications suggested by the American Gas and Electric Service Corporation. The basic idea was simply this:—Insulation levels are dictated by the impulse voltages that can reach windings. Limit those impulse voltages, by better design and placement of arresters, and insulation can be lowered. In other words, treat arresters as an integral part of the "insulation system" of a transformer, and you often will save on overall cost.

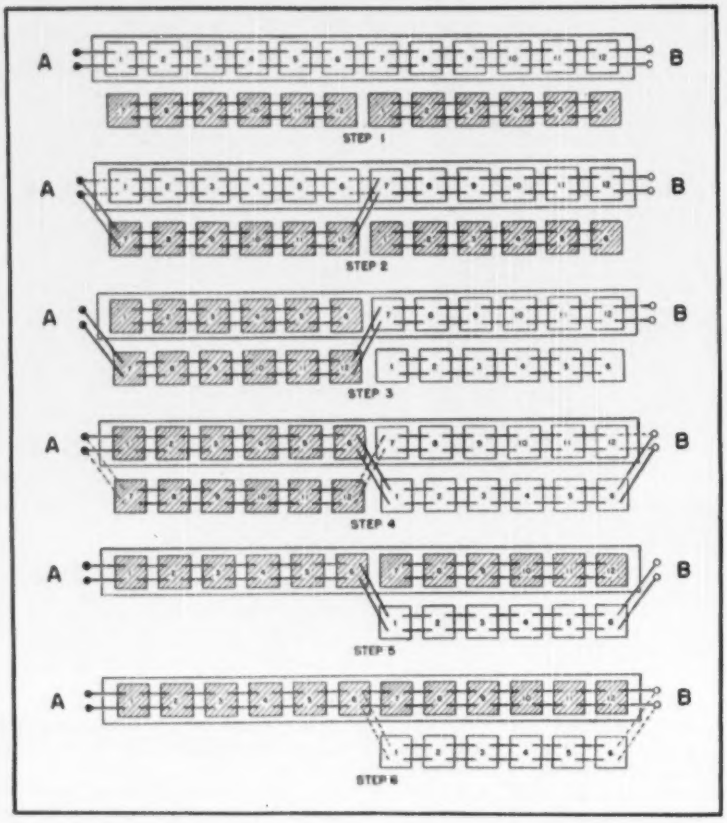
This was a theory. High-voltage research proved it to be a fact. The transformers for American Gas were built with an insulation level one step lower than had ever proved practical before.

These transformers—and many others like them have followed. Lowering insulation one step on transformers saves purchasers 10 to 12 per cent wherever circuit conditions permit their installation.

GENERAL ELECTRIC

How to Replace a Stationary Battery Without Interrupting the Circuit

When it becomes necessary to install new standby storage batteries, it is often desirable to make the changeover without interrupting service. One method of making the changeover is shown in the accompanying step-by-step diagram. The method is suggested by the Laboratories of the Gould Storage Battery Corp, Depew, N. Y.



STEP 1—Top row is old battery, on rack, connected to circuit. Lower row is new battery on floor, connected in groups of 6 cells. Note numerical sequence of new cells. Inspect new cells before disturbing old circuit.

STEP 2—Install flexible connectors from cell 7 of new battery to terminal A, and from new cell 12 to old cell 7. Remove old connectors from terminal A to old cell 1, and from old cell 6 to old cell 7. Do not remove old connectors until new circuit is complete.

STEP 3—Remove cells 1 to 6 in the old battery and replace them with cells 1 to 6 of the new battery. Cells 1 to 6 of the old battery are placed on the floor so that they can be used to maintain a full circuit in Step 4.

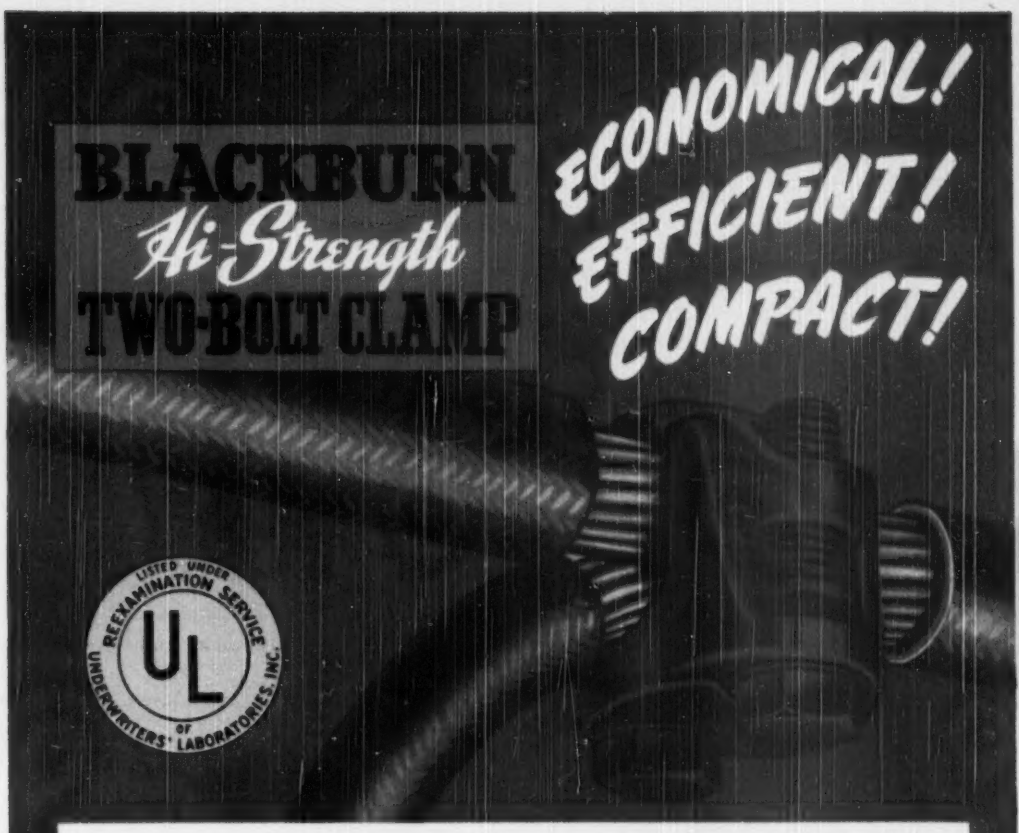
STEP 4—Install permanent connectors from terminal A to new cell 1; flexible connectors from new cell 6 to old cell 1 and from terminal B to old cell 6. Remove connectors from new cell 12 to old cell 7, from terminal A to new cell 7 and from terminal B to old cell 12.

STEP 5—Replace old cells 7 through 12 with new cells 7 through 12. Place old cells 7 to 12 in packing case in which new battery arrived and remove them from the battery room, preparatory to final Step 6.

STEP 6—Install permanent connectors from terminal B to new cell 12 and from new cell 6 to new cell 7. Remove flexible connectors from new cell 6 to old cell 1 and from terminal B to old cell 6. Place old cells in packing cases as in Step 5 and remove from battery room.

BLACKBURN
Hi-Strength
TWO-BOLT CLAMP

ECONOMICAL!
EFFICIENT!
COMPACT!



A BETTER CABLE CONNECTOR AT LESS COST!

- Especially designed for medium and large stranded wire and cable.
- Produces very high clamping pressure resulting in low resistance joints on stranded wire.
- It costs much less than other types of connectors commonly used.
- It is excellent for dead ends, taps, and service entrance connections and will accommodate a range of wire sizes.
- Exclusive helical serrations in both body and cap, conforming to the lay of stranded wire, together with the high clamping pressure produce a joint which will not pull apart. Thus the Blackburn Two-Bolt CLAMP is excellent for dead ending.
- It's made of high strength alloys throughout. Its extra strength maintains the high "pressure between wires" indefinitely. Thus it makes a lasting, trouble-free connection.
- It's compact and easy to tape — makes a neat joint.
- It's simple and easy to install.
- Made in sizes 1/0 to 1000 MCM.

Jasper Blackburn Products Corp.
Builders of Quality Connectors for 15 Years
FIRST, MADISON AND CLINTON STS. • ST. LOUIS 6, MO.
Phone CEntral 3007

Mail Coupon for Sample and Full Details

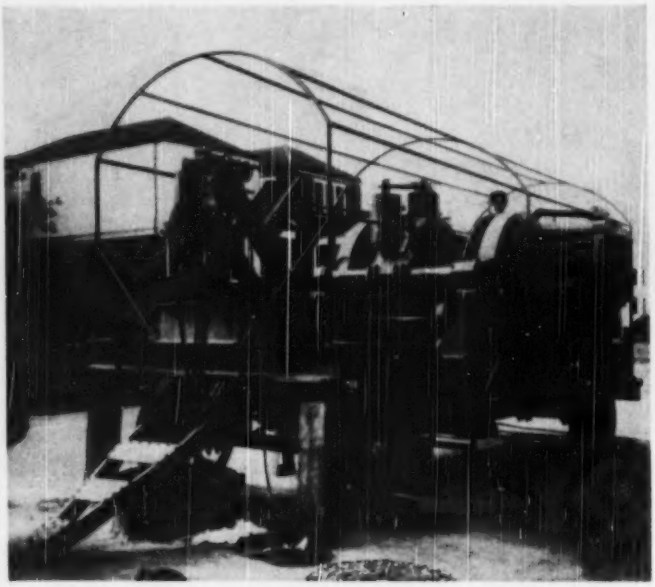
Send me sample and further information on the BLACKBURN TWO-BOLT CLAMP.
Wire Size Used_____
Your Name_____
Company_____
City & State_____ EW

Resistor-Shunt

(*Continued from page 98*)

Connections are shown for checking the recorder. Referring to the schematic diagrams of the recorder and of the testing device, the S_1S_2 terminals of the test shunt are connected to the recorder terminals normally connected to the field-current shunt. For checking the 70 C indication, the F_2F_3 taps of the pancake coil are connected to the recorder terminals normally connected to the field-winding terminals. For checking the 120 C (or 125 C) indication, the F_1F_2 taps are used. In all cases the F_1S_1 terminals are connected to the station battery. Charts showing the connections for checking recorders are permanently attached inside the cover of the test device case. The machine and recorder to which connections apply are indicated whenever more than one recorder is in operation.

• • •



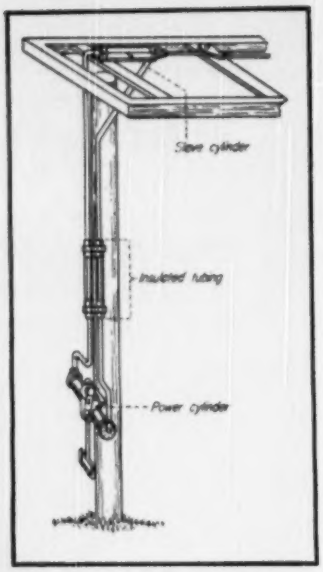
CONVERTED LST WINCH is used for pulling cable lengths up to 3,000 ft. Coming from the manhole, the steel line passes over a sheave suspended in a cantilever-type element which contains a dynamometer and a footage counter. Passing back to the reel, the cable goes through a guide which moves across the line of pull, distributing cable evenly on drum

Cable Pulled Quicker With an LST Winch

A NEW approach in cable pulling equipment was required recently in order to handle long lengths of cable with pulling stresses ranging up to 30,000 lb. In a pipe-type cable system, being used in place of LP oil-filled systems, cable sections of the order of 3,000 ft in length are possible. The Consolidated Edison Co of New York, Inc, adapted a war surplus LST anchor winch to do the job.

Drum of the winch was redesigned to hold 3,300 ft of 1½-in. steel wire-pulling line. The dc motor was replaced with a six-cylinder gasoline-driven engine with a torque converter. The unit was designed to give a 30,000-lb pull with a full drum of cable at a speed of 25 fpm.

The device materially reduced the operating personnel required for such a job, since the normal pulling device for this type of work requires the cable to be re-reeled on a separate reel for every pull. Using the converted winch, Consolidated Edison crews were able to install two sections of cable per day.



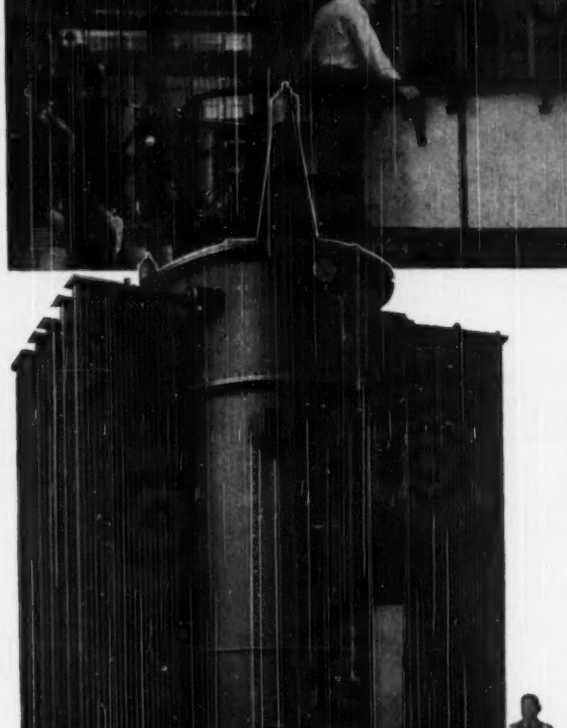
OPERATING HANDLE forces fluid from double-acting hydraulic cylinder through tubing to cylinder at switch location on top of structure. Fluid forced into this cylinder acts on piston connected to rotating insulator to operate switch, through interphase shaft

Hydraulic Mechanism Operates Group Switches

HYDRAULIC EQUIPMENT for operating group switches has been developed by the Royal Electric Manufacturing Co. Basic principle of the mechanism is displacement of fluid between two cylinders.

By actuating a piston in the power cylinder with an operating handle, fluid is forced into the blind end of the cylinder and, moving through tubing to the "slave" cylinder at the switch, forces fluid into the blind end of the "slave" cylinder. This moves the piston in the "slave" cylinder. The piston rod is directly connected to the rotating insulator and operates the switch. The three poles of the group operated switch are connected with the usual interphase shaft. For remote control the manually operated power unit is replaced by a motor driven pump.

In the hydraulic cylinder forming the power unit, provision has been made for booster action to develop extra pressure to overcome operating



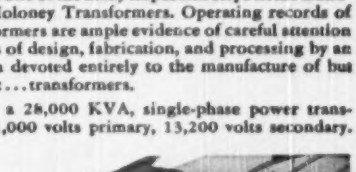
JUST ONE STEP . . . BUT *IMPORTANT*

VACUUM TREATMENT—Atmospheric moisture in insulating materials used in transformers reduces their dielectric and impulse strength. Amounts of moisture insufficient to cause breakdown on standard applied-potential and induced-potential tests may cause insulation failure under impulse conditions to which the transformer is normally subjected. Because Moloney recognizes the extreme importance of this step in production, core-and-coil units of all Moloney Transformers must be absolutely dry before they are placed in their tanks.

As illustrated above, units are placed in one of a battery of vacuum tanks. First, heat is applied by means of steam coils, evaporating some of the moisture. Then the air is removed from the tank and high vacuum maintained until test readings show the core-and-coil unit to be dry.

This is but one of the many important steps in the manufacture of Moloney Transformers. Operating records of these transformers are ample evidence of careful attention to all details of design, fabrication, and processing by an organization devoted entirely to the manufacture of but one product . . . transformers.

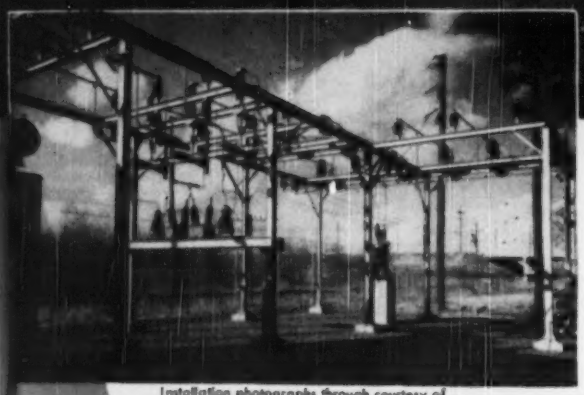
At left is a 28,000 KVA, single-phase power transformer, 161,000 volts primary, 13,200 volts secondary.



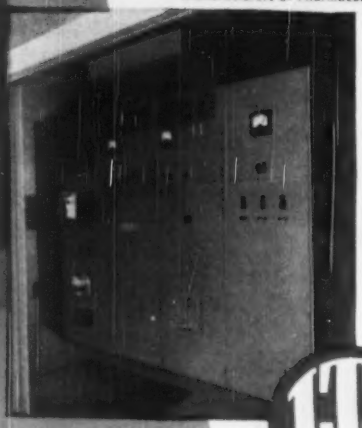
MOLONEY ELECTRIC CO. ☆ ST. LOUIS 20, MO.

POWER AND DISTRIBUTION TRANSFORMERS EXCLUSIVELY SINCE 1896

Service system



Installation photographs through courtesy of Hoffman La Roche, Inc., Nutley, N. J., Manufacturers of Pharmaceuticals.



4000 KVA substation. Incoming voltage 26.4 KV. Outdoor structure layout prepared by R&IE*. Air break switches are type TTR rated 34.5 KV, 600 amperes.

Indoor switchboard is I-T-E type HV. Breakers are rated 1200 amperes continuous, 4160 volts, 150,000 KVA interrupting.

* An I-T-E subsidiary.

Here's another electrical switching and protection problem solved—economically and positively. The I-T-E switchgear installed provides complete protection from point of power entry to individual feeder circuits.

HERE'S WHY:

• APPLICATION WAS PLANNED TO FIT A SPECIFIC NEED. No two distribution systems are absolutely alike. I-T-E sales engineers start with an analysis of *your* system and make recommendations and application based on what is required to provide adequate protection.

• EQUIPMENT IS EFFECTIVE AND DEPENDABLE. The design of I-T-E components evolves from over 60 years experience in building electrical switching equipment. The confidence in I-T-E gear results from the performance of equipment installed over that period of time.

• UNITS ARE PROPERLY COORDINATED I-T-E furnishes an *engineered* assembly. All breakers, relays, instruments, transformers and switches are functionally

I-T-E

For *more dependable* Switchgear

specify I-T-E

I-T-E Circuit Breaker Company • 19th & Hamilton Streets • Philadelphia 30, Pa.

Power Switching Equipment: Railway & Industrial Engineering Co., Greensburg, Pa.

Canadian Mfg. & Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., New York

SWITCHGEAR • UNIT SUBSTATIONS • ISOLATED PHASE BUS STRUCTURES • CIRCUIT BREAKERS • MECHANICAL RECTIFIERS
RESISTORS • SPECIAL PRODUCTS

continuity assured with

protection by I-T-E

arranged and conform to the recognized codes specifying safe and accepted practice.

• DESIGN FACILITATES INSPECTION AND MAINTENANCE. Complete and ready accessibility of all parts makes inspection fast and easy. More inspection per allotted hours of time results in better system maintenance.

• "PACKAGED DELIVERY" SIMPLIFIES INSTALLATION. I-T-E switchgear is assembled, tested and shipped as a complete unit or series of units. Only positioning and connecting is required in the field.

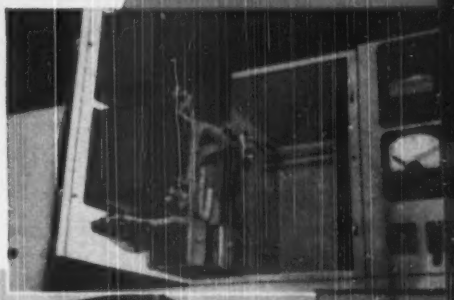
• FULL RESPONSIBILITY ASSUMED. I-T-E accepts complete responsibility for the operation and performance of every component furnished on your order. This includes purchased auxiliaries as well as equipment manufactured by I-T-E.

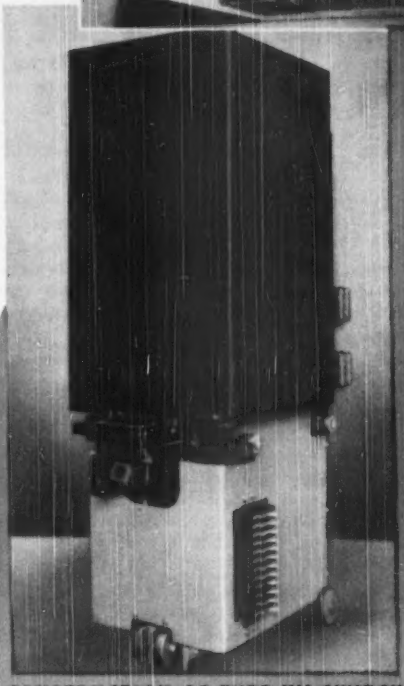
GET THESE HELPFUL BULLETINS

On I-T-E 600 V Switchgear Assemblies: A complete reference guide, containing detailed information on Multumite construction, and helpful facts for specifying and ordering complete switchgear equipments. Ask for Bulletin 6003-D.

On I-T-E 5 KV Assemblies: Describes I-T-E's newest 5 KV Switchgear. Easy-to-read drawings and diagrams supplement photos and text. Ask for Bulletin 7000-A.

Ask your local I-T-E Representative for these bulletins, or write I-T-E General Offices.





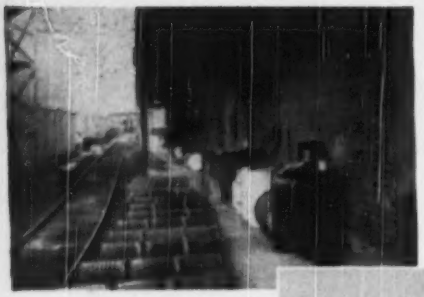
CONSTRUCTION OF TYPE HV SWITCHGEAR EMPHASIZES ACCESSIBILITY

Meters and instruments (above) are semi-flush mounted on hinged doors in individual compartments.

They are easily reached for inspection and maintenance.

Circuit breakers of the HV type below are horizontal drawout truck mounted.

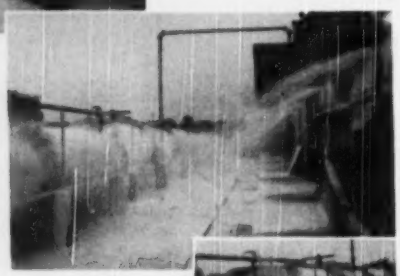
No transfer dolly or elevator mechanisms required.



TOP: General view of the protected area.

CENTER: Foam discharge at the rate of 2 in. per min.

BOTTOM: Area covered by 6 in. of foam blanket in 1 min.



it's NEW!

"Automatic" AER-O-FOAM PROTECTION FOR INDUSTRY

For many years fire protection engineers have been faced with the problem of finding a feasible answer to the hazard caused by crowded plant facilities where flammable liquids are involved. Conditions of this type exist in many chemical processing industries, metal working plants, petroleum storage and handling and electric power generation properties. A severe hazard was evident at the Schenectady Varnish Company, Schenectady, N. Y., where fire at the tank car loading racks and storage facilities presented a constant threat to the operation of the entire plant.

Having had a background in the development of all types of automatically operated fire protection equipment, "Automatic Sprinkler" engineers designed and installed the mechanical foam system, test photos shown above, and which is now commercially identified as "Automatic" AER-O-FOAM.

The important engineering advantages of this form of protection are evident in the improvement of drainage conditions, reduction of water supply requirements, non-corrosive action of the foam material, positive fire extinguishment and prevention of reflash. As "Automatic" AER-O-FOAM dehydrates rapidly following application, clean-up operations are held to a minimum.

Fuel oil storage, oil cellars and many other hazards familiar to power generation can now be positively protected through the media of "Automatic" AER-O-FOAM. Your nearest "Automatic Sprinkler" representative will be glad to show you how and—at no obligation to you. Write or call today for descriptive literature.

"AUTOMATIC" SPRINKLER CORPORATION OF AMERICA
YOUNGSTOWN 6, OHIO

"Automatic" Sprinkler
FIRST IN FIRE PROTECTION
DEVELOPMENT · ENGINEERING MANUFACTURE · INSTALLATION
OFFICES IN PRINCIPAL CITIES OF NORTH AND SOUTH AMERICA

resistance caused by ice and corrosion. In case normal switch operation is impeded the operator can bring the booster into play to build up the required pressure to open or close the switch without undue physical effort.

Pressures can be developed in the order of 1,000 psi and equipment is protected from excessive pressure by a pressure relief valve. In normal operation pressures less than 300 psi are developed.

Insulation of the operating handle may be accomplished by inserting a synthetic rubber tube section in the tubing carrying the operating fluid. The interphase shaft is insulated with a standard wood section. Equipment can be designed for mounting on wood or steel structure.

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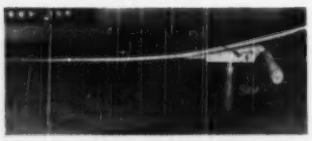
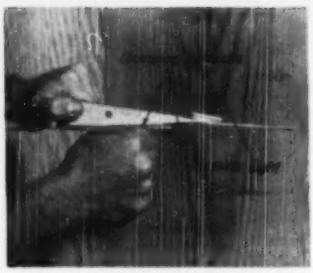




EASY INSTALLATION (top) of vinyl plastic tubing for protection against tree grounds is accomplished with this special tool developed by Southern California Edison Co. Pin moving in slot at an angle to parallel clamping surfaces on the two parts provides a wedging action to grip conductor as tubing is applied. "RIFLE SIGHT" on tool (above) spreads tubing (which has a lengthwise slit) and guides it as it goes onto conductor. Parallel clamping surfaces are above and below conductor to provide a wedging action

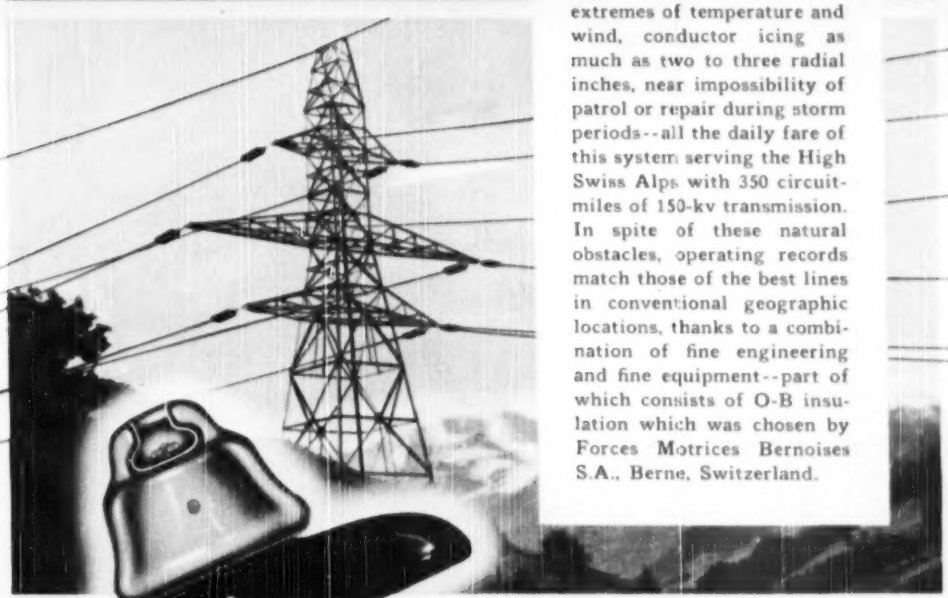
Plastic Tubing Provides Excellent Tree Protection

S. L. THEETGE
Southern California Edison Co.
Los Angeles

VINYL PLASTIC TUBING is being used with excellent results by Southern California Edison Co to protect telephone circuits from intermittent tree grounds. Such grounds can cause false operation of alarms or inter-

HI-TENSION NEWS *Junior*

For carrying 150 kv over the Swiss Alps O-B is the Choice of Insulators



Here is a spectacular assignment for any power line: high altitudes, steep terrain, extremes of temperature and wind, conductor icing as much as two to three radial inches, near impossibility of patrol or repair during storm periods--all the daily fare of this system serving the High Swiss Alps with 350 circuit-miles of 150-kv transmission. In spite of these natural obstacles, operating records match those of the best lines in conventional geographic locations, thanks to a combination of fine engineering and fine equipment--part of which consists of O-B insulation which was chosen by Forces Motrices Bernoises S.A., Berne, Switzerland.

Ohio Brass

MANSFIELD, OHIO, U. S. A.

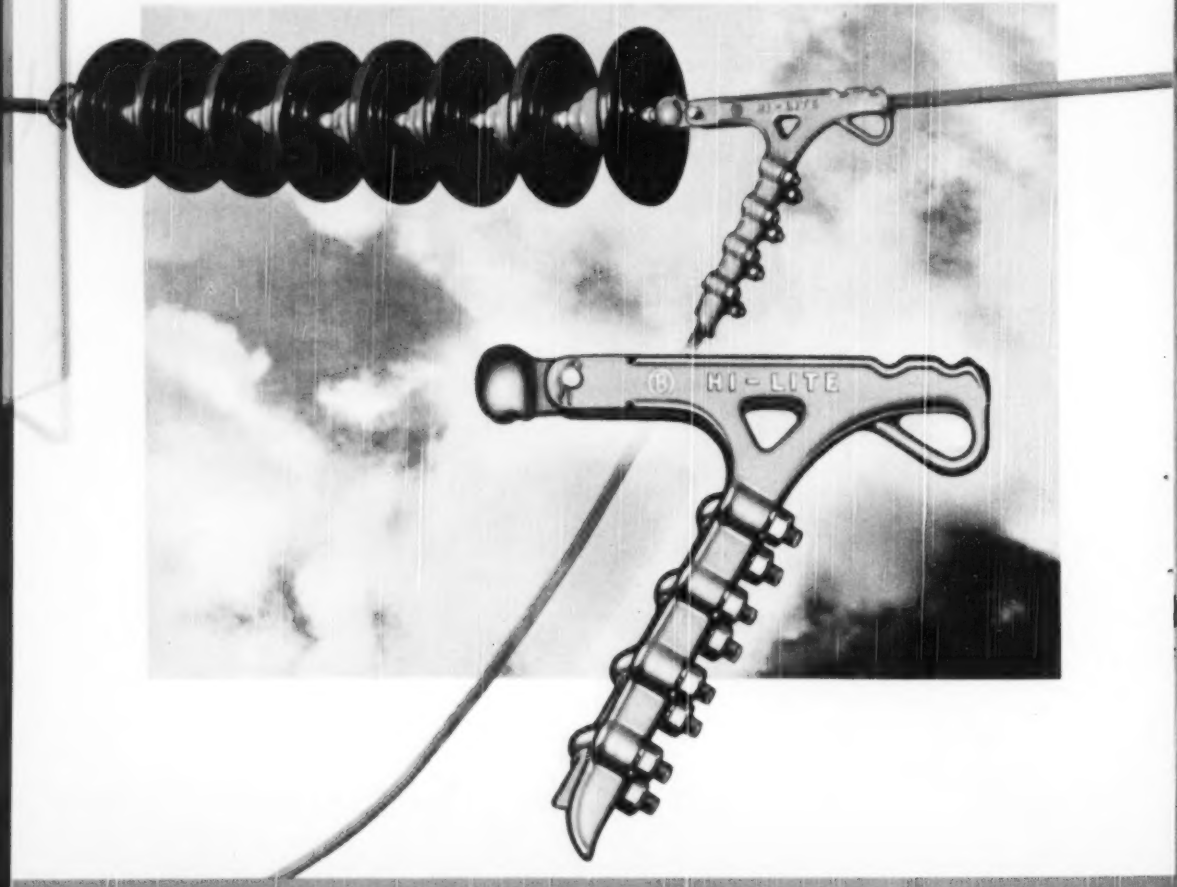
HI-TENSION NEWS Junior

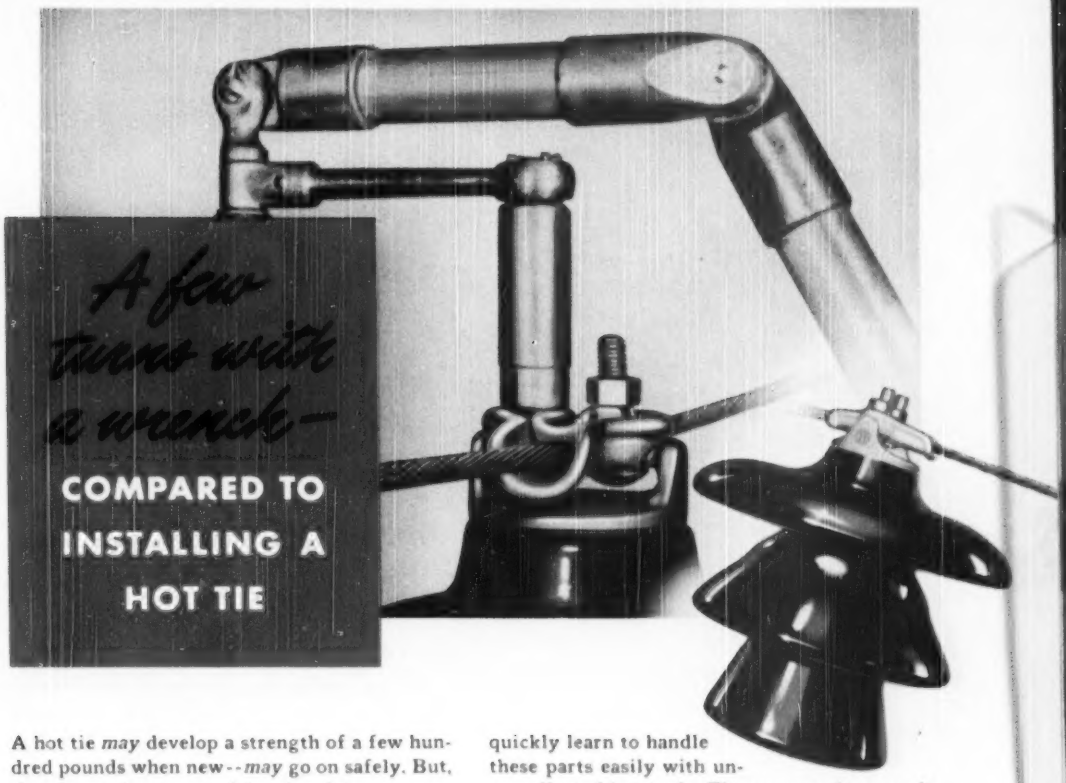
A Continuous Power Cable from Terminal to Terminal

Jumper splices at strain points in a transmission line are potential trouble-makers after a few years of load conditions. This trouble can be stopped by the practice of stringing through such points with an uncut conductor. By doing this you gain the effect of a continuous conductor from terminal to terminal, since line splices under high mechanical tension are much less subject to deterioration.

Continuous-cable jumpers are easy to install when using O-B strain clamps. The bolted connection makes up easily in the field without special equipment or specialized training of line crews, and will develop at least 90 per cent of the cable's ultimate strength without slip. Clamps may be loosened and relocated on the cable if adjustment in sag is necessary. The bolted clamp is also subject to effective inspection during installation as well as at any later time desired.

O-B strain clamps give you a combination of advantages not found in any other dead-ending practice. Specify them on your next transmission line.

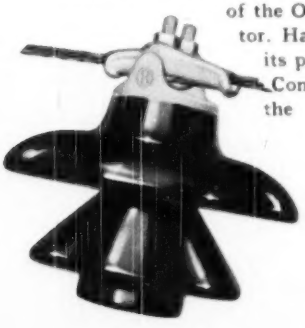




A few turns with a wrench—

COMPARED TO INSTALLING A HOT TIE

A hot tie *may* develop a strength of a few hundred pounds when new--*may* go on safely. But, there's another type of hot insulator connection that will produce a holding power of 2,000 to 2,400 pounds, *every time*, and that's even safer than merely lifting a conductor with hot sticks. This is the mechanical clamp connection of the O-B Clamptop insulator. Have you investigated its possibilities?



Conductor is attached to the insulator head by means of a simple clamp with two hex nuts. Men quickly learn to handle these parts easily with uncomplicated hot tools. There are no loose ends of energized tie wires to deal with. The O-B Clamptop is a compact, self-contained unit--safest for the hot line workman.

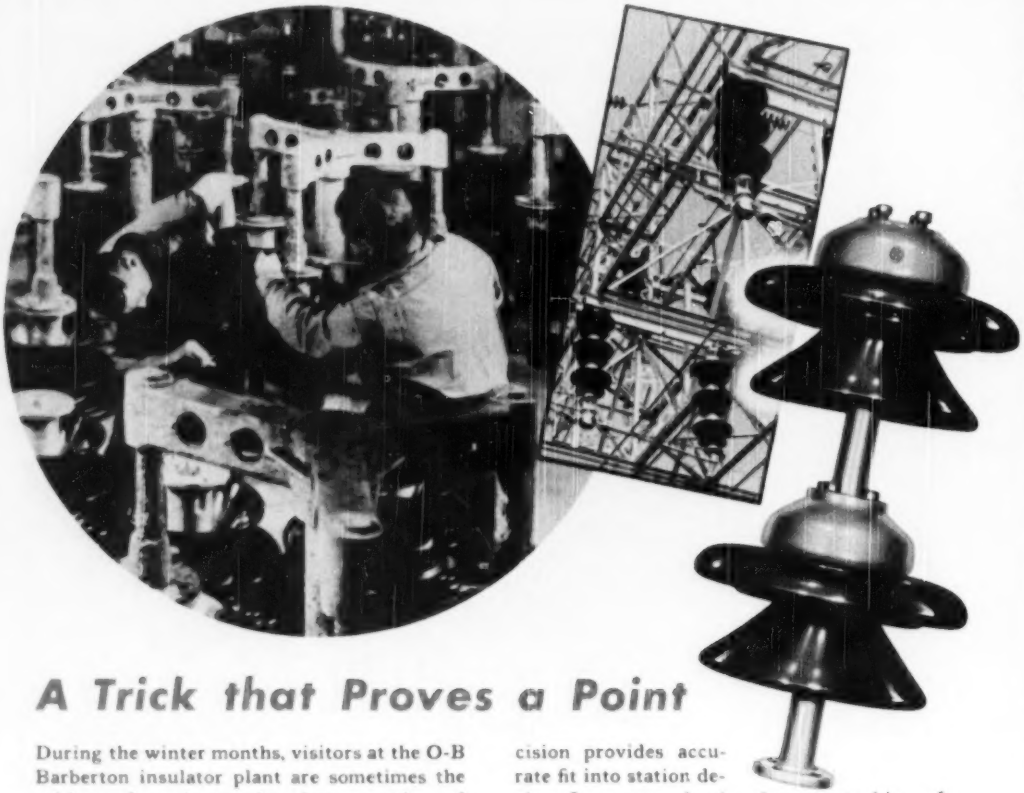
Because of the permanent tie connection, improved electrostatic field, and semi-conductive glaze treatment, the O-B Clamptop has the lowest radio-influence level of any style or form of pin insulator. Add this to its hot-working safety and you have a combination that deserves active attention. Order a quantity and give them a trial on your own terms.

Ohio Brass

MANSFIELD, OHIO, U. S. A.

(B)

HI-TENSION NEWS *Junior*



A Trick that Proves a Point

During the winter months, visitors at the O-B Barberton insulator plant are sometimes the subject of an impressive demonstration of accuracy. They are handed a station insulator and asked to slide it into its assembly jig. It is contrived to have the visitor leave the unit in the jig and, as soon as he departs, a nearby window is opened and the jig chilled by cold air. A few minutes later the man is brought back and asked to pick up the insulator--a team of horses couldn't withdraw it! The slight contraction of the cooled jig acts like a vise. It's an effective demonstration of the accuracy of O-B assembly.

This trick has a moral, however. Such precision provides accurate fit into station design. It assures plumb columnar stacking of multiple units. It holds switch parts in true alignment for smooth operation. This accuracy is best understood when you see the effect of only a few thousandths of an inch shrinkage in the assembly jig.

We're not trying to "trick" anybody into buying an O-B insulator, but it is sometimes difficult to believe the refinements possible in combining metal and porcelain; and this is only *one* of the refinements that makes O-B switch and bus units the outstanding insulator for trouble-free station service.

Ohio Brass

MANSFIELD, OHIO, U. S. A.

3037-B

fere with supervisory control and other functions of communication circuits. The tubing is much lighter and therefore reduces sag in spans compared with heavier wood moldings formerly used. In addition to its light weight, the tubing is water-resistant so it does not soak up water as the wood moldings did after being exposed to the weather for some time.

After three years experience with the tubing, during which about 500,000 ft have been applied without a single case of trouble, Southern California Edison anticipates that its life will be considerably better than any wood molding used heretofore.

The tubing most used is $\frac{1}{2}$-in. outside diameter and $\frac{9}{32}$-in. inside diameter with a plus or minus tolerance of 0.015 in. It is extruded of green vinyl plastic, with a helical lengthwise slit that makes one revolution in two feet. Color permanence and resistance to weathering have proven to be excellent.

The special tool shown has been developed by the company for quick and easy application of the tubing, generally in 20-ft sections. The tool is made of two parts. The upper part has a guide similar to a front rifle sight, to spread the split in the tubing and serve as a guide as the tubing goes on the conductor. The lower part provides a grip for the workman's hand. The pin holding them together slides in a slot at an angle to their two parallel clamping surfaces, providing a wedging action which grips the conductor firmly as the tubing is being fed onto it.

The tubing slips easily over pressed sleeves, and is much easier than the wood molding to push through dense tree growth. Lower cost of installation, elimination of objectionable sag and associated trouble calls, and longer life of the tubing add up to savings of several thousand dollars annually for the company.

Orders and Reports Reproduced by Offset

THE PURCHASING DEPARTMENT of Cleveland Electric Illuminating Co

estimates that it has saved "thousands of dollars annually" in time and manpower by changing from typed carbon copies to offset reproduction of purchase and receiving blanks.

This way as many copies of a given purchase order and receiving report as are needed by the various departments and divisions of the company can be produced quickly from a single master. The receiving copies, blind as to quantities, go to the receiving points where quantities received are entered.

Machine Accounting Speeds Work, Cuts Costs

F. W. FRANTZ
Supervisor Property and Plant Accounting
The Dayton Power and Light Co
Dayton

During the post-war period, anticipating an unprecedented construction program and realizing that property and plant record keeping would have to be geared to cope with extraordinary volumes of transaction recordings, The Dayton Power and Light Co converted such records from hand posting and balancing to machine accounting. Forms were designed and procedures outlined to change the manual posting and balancing of construction work in progress, retirement work in progress and property and plant ledgers to machine accounting.

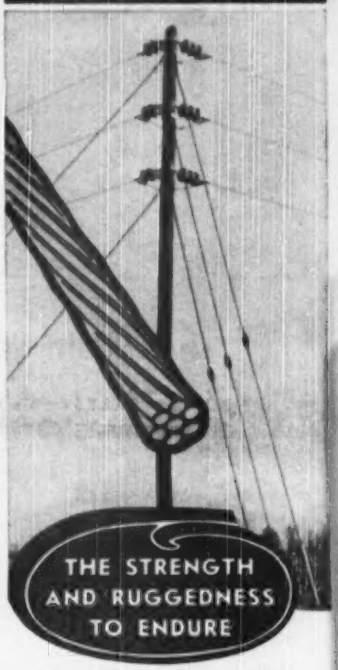
Substantial Savings in Time

As a result, substantial savings in time required to accumulate detail costs have been effected. The magnitude of the job can be more fully appreciated when the volume of open work orders is taken into account. In the post-war years, the company has been issuing and closing approximately 15,000 construction and retirement work orders annually, which represents an increase of about 242% over the volume handled previously.

Equally important is the fact that personnel have been freed from tedious routine duties and made available for assignments where they may exercise qualities of judgment and discernment. Lastly machine posting has made for a neater and more legible record.

Incidental to this change, all records relating to work orders were standardized as to size, form and content with the plan in mind that such construction records could be microfilmed upon completion for permanent filing, thus reducing the area of storage facilities required.

Crapo
GALVANIZED STEEL
STRAND



STRENGTH to support the pole structure under maximum ice and wind loading . . . RUGGEDNESS to withstand the punishment incurred in construction and service . . . DURABILITY that outlasts the normal expectant life of the line . . . are combined—with important ECONOMY — in Crapo Galvanized Steel Strand.

Each size and grade develops the full tensile strength of the steel in cross section. The heavy, ductile, tightly-bonded zinc coating—applied by the famous Crapo Galvanizing Process—provides dependable protection for the steel.

ASK YOUR JOBBER!

There is a size and grade of Crapo Galvanized Steel Strand for every practical need. Consult the distributor of Crapo Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE INDIANA

The Ideal Power Sales Engineer—What is His Job?

Here is a composite picture of the functions and responsibilities of an industrial power sales engineer. It represents the ultimate that might be expected of a well trained and experienced man

D. B. HYER, JR.
Director Industrial Development
Florida Power Corp
St. Petersburg, Fla.

UNDER general supervision, but with wide latitude for planning and laying out of working details, and working primarily alone, the power sales engineer shall be responsible for results in handling all industrial power applications both large and small. Working alone or in cooperation with others he will perform in a satisfactory manner the following and related work as assigned:

1. Develop and negotiate the sale of electric energy (including the actual preparation, presentation and the obtaining of management's approval and execution of contracts) for industrial power, lighting and heating, to new and existing industries; in the 3 general categories below.

a. By converting isolated, privately-owned power plant operation to purchased power.

b. By the sale of purchased power service to all new industries.

c. By complete electrification of existing industries through greater use of purchased power service. By replacing, where economical, other methods of energy supply with purchased electricity. By broader application of purchased power to existing processes and to additional processes leading to complete electrification of all power, lighting and heating, in existing industrial plants.

2. Compile and maintain prospect lists resulting from surveys, market analysis, etc, covering all phases of additional use of electric energy by new and existing industries.

3. Be familiar with the company's generating, transmission and distribution facilities, rates, rules, regulations, policies and other procedure affecting customers.

4. Maintain sufficiently close contact with all industrial customers (in cooperation with local or territorial managers) so as to be aware of any development in all forms of competition and/or possible deterioration in customer relations. Prepare and present the necessary cost and rate comparisons, service, analyses, etc, to meet and defeat such threatened competion and/or good will problems.

5. Whenever scheduled interruptions to customer's service are necessary on account of construction or maintenance work, on-peak curtailment of load, etc, endeavor to arrive at time and duration mutually agreeable to customer and company.

6. Assist local or territorial managers, at their request, in the study of customer complaints and proper application of available power rates, rules and regulations. Act as liason between customer and all interested departments of company in case of unscheduled interruptions in service, low voltage, high bill complaints, tests of various kinds and, when required, financial and credit matters.

7. Negotiate sale of power to municipalities for water pumping, street lighting and other municipal services. Also for wholesale energy supply to replace private generation, where municipality operates its own distribution system.

8. Negotiate contracts for sale of wholesale energy to REA Cooperatives.

9. Cooperate with local managers, chambers of commerce and other interested groups in the preparation of reports, inventories, prospectuses, etc, for the attraction and development of new industries in the communities served.

10. Prepare complete power reports covering cost, economies, operations, etc, where necessary, in connection with proposed municipal plants or private generation problems.

11. Analyze the processes of industrial customers to the extent of being in a position to recommend possible improvements in operation to broaden and economize the use of purchased power.

12. Establish and maintain relations with equipment and apparatus manufacturers, consulting engineers, architects, contractors, customer trade organizations, etc.

13. With or without the assistance of operating personnel, make tests of customer's equipment toward the end of determining proper applications, power

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

This flashover of a horn gap illustrates the kind of power available at the High Power Laboratory . . . power of sufficient magnitude to verify designs for interrupting fault current as high as 10,000,000 kva.

Here's *SURENESS*... in the Making!

Sureness doesn't spring from skillful engineering and quality manufacturing alone. It takes testing, too . . . rigid design testing on a scale equaling the severest kind of service conditions. Fault currents of tremendous magnitude, sub-zero weather, severe icing conditions, searing flashovers . . . these are only a few of the tests given every new Westinghouse design.

This business of making *sure* . . . of anticipating and duplicating every conceivable service condition, is the work of the Westinghouse High Power Laboratory . . . for 25 years the proving ground for all Westinghouse electrical apparatus. This is where we make *sure* . . . and this sureness is passed along to you. It backs up every Westinghouse label, whether it appears on a tiny switch, a giant circuit breaker or the world's largest lightning arrester. J-60097

SEE FOR YOURSELF!

Booklet B-4383 describes facilities, procedures and actual tests conducted at the Westinghouse High Power Laboratory. Ask your Westinghouse representative for a copy of B-4383, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

Westinghouse

HIGH-POWER LABORATORY

factor correction, etc.

14. Supervise the preparation of lighting and wiring layouts and drawings for new and existing industrial customers. (This layout work may be done by qualified engineers of another department in cooperation with the power engineer.)

15. Assist the commercial sales department in any case of commercial customers considering possible oil engine or steam generation in competition with purchased power when requested.

16. Maintain billing records, unit cost data, contract terms, etc, for all industrial customers in territory assigned and complete prospect files in connection with the three specific categories of industrial business outlined in Paragraph No. 1.

17. Make daily or periodic reports of own activities and of customer trends. Assist in preparation of industrial power forecast, expense budgets, forecast of sales of wholesale energy, etc.

18. Furnish any special assistance to the local or territorial managers in connection with municipal or industrial problems and prepare such special assignments as required.

While we gathered that our subject did not necessarily include an analysis of educational qualifications of such a man as might be capable of adequately accomplishing all of the above, we believe it is rather apparent that an engineering education or equivalent experience is almost absolutely necessary. In this connection there are, of course, also the usual personal qualifications of alertness, sales ability, personality, tact, etc.

Naturally these functions are not those of a new man, totally unfamiliar with this type of work, but they could at least tell a new man what he has to work toward and, if they do not scare him to death, such a list of qualifications may make a new man realize what he must aim at if he intends to be an "Ideal" power sales engineer.

Based upon material presented before Industrial Power Committee of SEE

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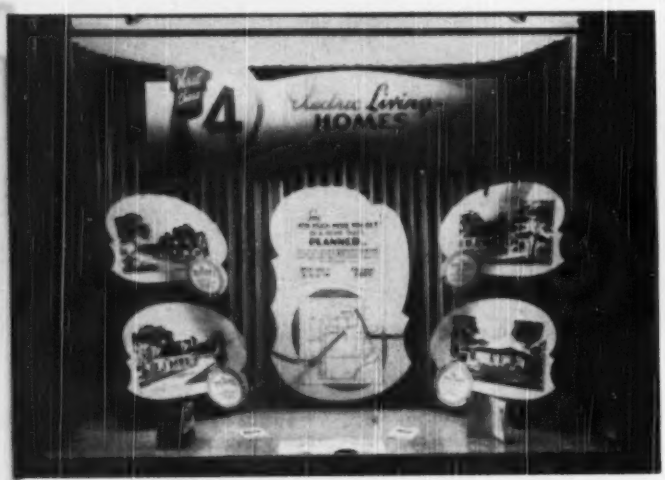


DISPLAYS in power company windows excited interest in model "Electrical Living" home

"Electrical Living" Homes Boost Appliance Sales

REFRIGERATOR sales usually decline in the fall. They did, but not nearly as much as the year before. Water heater sales also are expected to drop in the fall. They went up instead. Automatic washer sales jumped up. Clothes dryers were completely sold out. Over 400 roasters were sold in 30 days. Garbage disposer sales increased 50%. These are some of the immediate effects of the Electrical Living Exposition in Indianapolis last Oct., jointly sponsored by Indianapolis Power & Light and Westinghouse. The Exposition consisted of 4 new homes designed to exemplify 4 degrees of electrical living—"Thrift," "Budget," "Ideal," and "De-Luxe." Installed electrical equipment began with a range, refrigerator, water heater, clothes washer, dryer, and kitchen ventilating fan.

80,000 Visitors

Over 80,000 people visited the 4 homes, and some 18,000 of them called at stores of Westinghouse appliance dealers to deposit cards in a drawing for 25 electrical merchandise gifts including a "Laundromat", television receiver, range, water heater and roaster, and totalling $1,014 in retail value.

A survey conducted among visitors to the homes indicated that 54% of the women liked the planned work-center kitchens; 75% preferred a first-floor laundry; 76% liked the concealed fluorescent lighting; 22% planned to modernize their homes; 21% planned to buy or build. Of electrical modernization features, 33% expressed preference for the laundry, 32% for the kitchen, 16% for lighting, and 13% for adequate wiring. Appliances wanted most were the automatic washer, 25%, and the clothes dryer, 21%.

The builders of the houses found that the visitors were greatly interested in electrical living. One sold out an entire development of 9 houses on which he was then engaged, and signed a contract to duplicate the model house that he had constructed for the exhibit.

To attract visitors to the 4 homes, extensive publicity was employed previous to their opening—dealer meetings, previous for groups directly concerned with the activity, feature sections in local newspapers, advertising by every available medium—newspapers, radio, car cards, direct mail, window displays, etc.

NEW FEATURE
"INDUSTRIAL BRIEFS"
Containing short, snappy
"Off-the-shelf", new
LOAD BUILDING APPLICATIONS
See Page 120

"Anaconda"...always means

Keeping-Ahead-of-the-Parade

TAKE CB* CABLE WITH F-3**
ALLOY SHEATH FOR INSTANCE:

In 1939

Anaconda engineers introduced Type CB cable because ordinary paper-insulated cable wasn't good enough. Carbon-black paper removes oxidation products from the insulation, eliminates ionization discharges. These and other desirable properties increase insulation stability and assure longer cable life.

In 1944

Anaconda engineers added the resilient binder for they had found a way to reduce sheath strain during daily load cycles. Made of special carbon-black paper, it is strong yet resilient, results in lower stresses in the sheath due to cushioning effect, conducts radially and is fully adequate against magnetic forces.

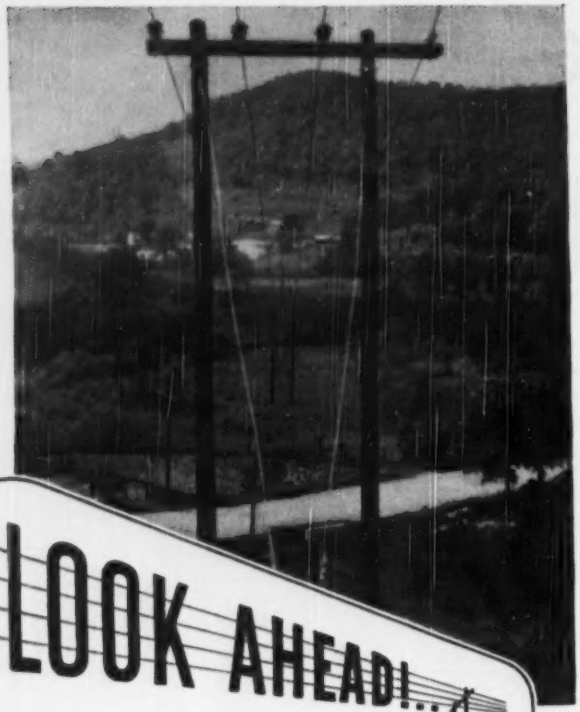
In 1944,

because they know cable life often is shortened by premature sheath failure, Anaconda engineers gave this Type CB cable the amazing F-3 alloy-lead sheath. It is the best all-around alloy ever offered in the industry . . . resists slow-bending fatigue, creep (expansion), bursting, abrasion, vibration fatigue and does not age-harden . . . actually extends sheath life more than three times ordinary sheath. It has truly earned the name "indefatigible."

*CB—Carbon-Black, Trade Mark Registered U. S. Patent Office
**F-3—Arsenic-Lead alloy (U. S. Patents 2,300,788 and 2,374,755)

THIS COMBINATION permits heavier loads for longer life!

ANACONDA WIRE & CABLE COMPANY
25 Broadway, New York 4, N. Y.



LOOK AHEAD!...

with Koppers
Pressure-Creosoted Poles

WHEN you purchase Koppers Poles, you can look ahead to *longer* pole life . . . to *longer* periods of continuous company service . . . to *lower* annual operating costs.

Koppers Poles are pressure-creosoted against decay for their full length. Because of highest standards of treatment, longest life is assured. Because they *retain* their strength, fewer poles go out of service, even under the most severe climatic conditions.

Be sure to specify Koppers Full-Length Pressure-Creosoted Poles. Then you will be all set to look ahead to the best pole service it is possible to purchase.

KOPPERS COMPANY, INC. Pittsburgh 19, Pa.

KOPPERS

Deliveries of Koppers Pressure-Creosoted Poles are made promptly from many conveniently-located treating plants.

PRESSURE-CREOSOTED WOOD

INDUSTRIAL BRIEFS

Better Lighting Jumps Production—Cuts Rejects at Pitney-Bowes, Inc, Stanford, Conn. A 25% increase in production and a reduction in rejects from six to less than one per cent was affected by improved lighting, one and one-half years ago. Overhead general fluorescent lighting in the 8,000-sq ft punch press department was increased to 35 fc at the working levels and, in addition, local fluorescent lighting of 100 fc was provided at each machine.

Infrared Improves Taste of Hamburgers—Reduces Cost at the Claridge Food Co, Inc, Flushing, New York. Up to 50,000 cans of hamburger patties are broiled and canned per day using about 250-kw in 500-w infrared lamps installed over conveyors, and operated daily. This infrared method is a great improvement over the previous method of cooking the hamburgers in vegetable oil.

Electrically Heated Kettles lower galvanizing costs—save zinc. C. J. Sodergren, Gas & Electric Co, Baltimore, reports study of galvanizing costs in six plants of a pole-line hardware manufacturer (3 plants operating fuel-fired kettles, and 3 using electrically heated kettles) show 32 to 41% lower over-all galvanizing cost in the electric kettles comparing plants with equivalent production. The *highest* over-all electric cost was 16½% below the *lowest* equivalent cost for the fuel-fired plants.

Electric Heat Cuts Gate House Heating Costs. At the Wright Aeronautical Corp, Wood-Ridge, N. J. an all-glass gate house is heated electrically at a total installation of $950 as against a $3,000 cost estimated for installation of a steam heating system. Gate house cube is about 1,100 cu ft with all-metal roof and insulated shingle covering. Installation includes a 3-kw unit heater; 4-kw strip heater, and a 2.5-kw electric-steam radiator. It keeps gate house at a comfortable 70 deg with zero weather outside. J. M. Petruska, Electrical Supervisor, reports all-electric system requires less maintenance and operating cost than an all-steam system.

NEW!

A Quick-Picture Of "Advanced Instrumentation" For Central Stations!

Send For Your Copy... Today!

HERE's thirty-two pages of easy-to-read information on the products and applications included in Brown Advanced Instrumentation for Steam-Operated Generating Stations.

You'll find the complete Brown line of indicating, recording, and controlling instruments covered . . . briefly and to the point. It tells the story completely and concisely.

Send for your copy of Bulletin 90-1 . . . today! And call in your local Honeywell engineer for a discussion of what Advanced Instrumentation can offer you . . . including the Brown Instrument Training School which is available to your employees. There's a Honeywell office as near as your phone!

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Offices in 77 principal cities of the United States, Canada and throughout the world

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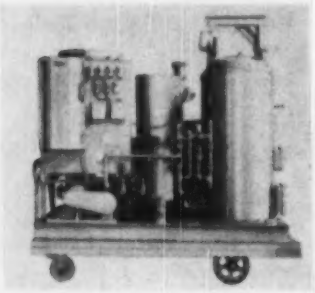
NEW EQUIPMENT



Purification System

COMPLETELY AUTOMATIC in operation, a newly designed Purivac purification system for transformer oils is reported to eliminate acidity, moisture and sludge, and restore dielectric strength in one operation. Other advantages of the system are said to include reduced deterioration of fabric insulation, prevention of excessive build-up of core moisture and prolonging life of insulating oil indefinitely.

The system consists of dual purifiers, heat exchanger, dehydrating and degasifying unit, electrical control panel, pumps and motors, all mounted on a dolly. Purification, dehydration and degasification cycles are thermostatically controlled. Dual purification operations can be operated separately, in series or in parallel. Purification operations may be carried out in the field or at the central station while the transformer is in service.

Honan-Crane Corp, 734 Wabash Ave, Lebanon, Ind.

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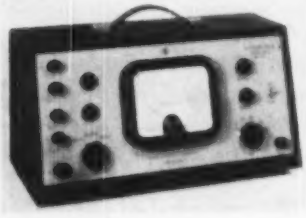

Electronic Timer

MEASUREMENT of time intervals between 0.1 and 10,000 milliseconds with an accuracy of 1 to 2% is claimed for the Chronotest timer. Two models are available, one with a top range of 1 sec in six steps and the other with a top range of 10 sec in six steps. Operation is from voltages of 110-250 v, 40–100 cycles, 1-ph.

The timer can be used for actual measurement of very short time intervals, or it can be used for timing intervals between changes in voltage, current, resistance, light intensity, sound level, and liquid level.

Herman H. Sticht Co, Inc, 27 Park Pl, New York 7, N. Y.

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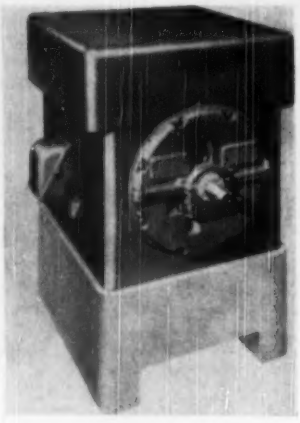
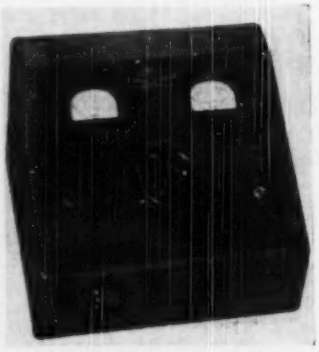


Auxiliary Motor

A MODIFIED base-ventilated motor, designed specifically for external applications such as driving power station auxiliaries mounted out-of-doors, is available in ratings of 200 to 3,000 hp. The motor is intended for mounting on a concrete base which is raised sufficiently from the ground to allow contaminated ambient air to flow through the foundation at high velocity. Ventilating air enters the motor through a vertical passage in the base.

After circulating through the motor, the ventilating air is exhausted from the top. Exhaust ports are protected by an overhanging metal shield and baffling but, in case air enters during a storm, adequate elimination and drainage are reportedly provided. A coarse mesh screen may be added to the base to give further protection if the surrounding air has a high cinder content.

General Electric Co, Apparatus Dept, Schenectady 5, N. Y.



Insulation Tester

AN ac insulation tester, Model 2402, has been designed for use where up to 2,000 v are required in measuring breakdown voltages and testing insulating materials, transformers and other items of reasonably low capacitance. A built-in variable transformer provides stepless control of the high voltage output (0–2,000 v ac, about 25 ma limit).

The instrument is equipped with a direct-reading voltmeter across the output, and a milliammeter which indicates exact point of voltage breakdown by an abrupt rise in indicated current. Extra scale ranges are provided to accommodate variations in supply line voltages. Accuracy is reported to be 2% of full scale. Weight is 16 lb.

Cole Instrument Co, 1320 S. Grand Ave, Los Angeles 15, Calif.

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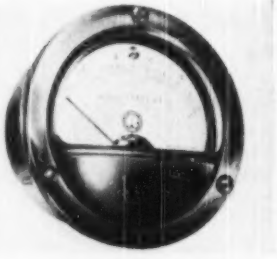
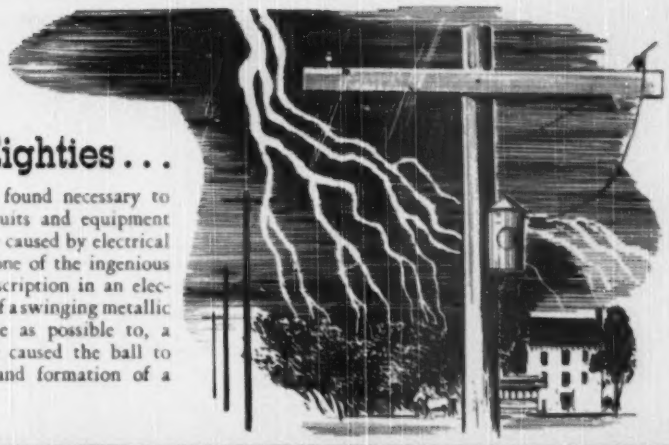


Panel Instruments

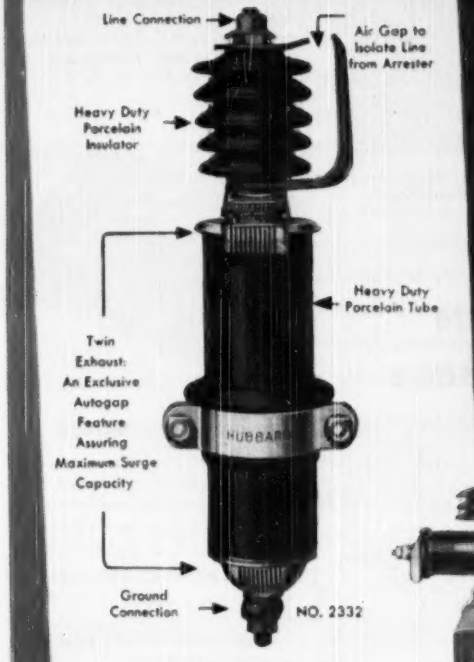
A NEW internally shock mounted D'Arsonval type movement, which has had its mass reduced, is incorporated in the Ruggedized line of panel instruments. Features include: (1) a new



In the Good Old Eighties . . .

Early in the electrical age it was found necessary to find some means of protecting circuits and equipment against the disturbances and damage caused by electrical storms. The "Razzle Dazzle" was one of the ingenious devices used. "It consists," the description in an electrical publication of that day says, "of a swinging metallic ball suspended above, and as close as possible to, a ground plate or table." Lightning caused the ball to swing, thus preventing a fusing and formation of a permanent ground.

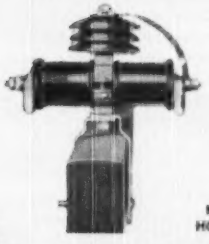
TODAY - The New HUBBARD VERTICAL AUTOGAP


Line Connection
Air Gap to Isolate Line from Arrester
Heavy Duty Porcelain Insulator
Heavy Duty Porcelain Tube
Twin Exhaust: An Exclusive Autogap Feature Assuring Maximum Surge Capacity
Ground Connection
NO. 2332

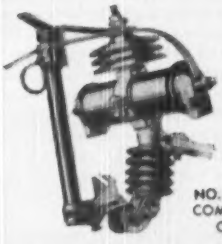
The new Hubbard Vertical Autogap possesses the same principles of design as the Hubbard Autogap Lightning Arrester for horizontal mounting, and offers an optional choice where a vertical mounting is desirable. All Hubbard Autogaps act on the expulsion principle. The follow arc is extinguished before it reaches the first current zero. A bracket is included, for mounting on pole, crossarm or transformer as desired.

Autogaps are also available in cutout combinations. Hundreds of thousands of Autogaps have proven their efficiency over an eleven year period, without a single failure resulting from operating conditions.

Write for complete details and specifications.



NO. 2302 HORIZONTAL STYLE



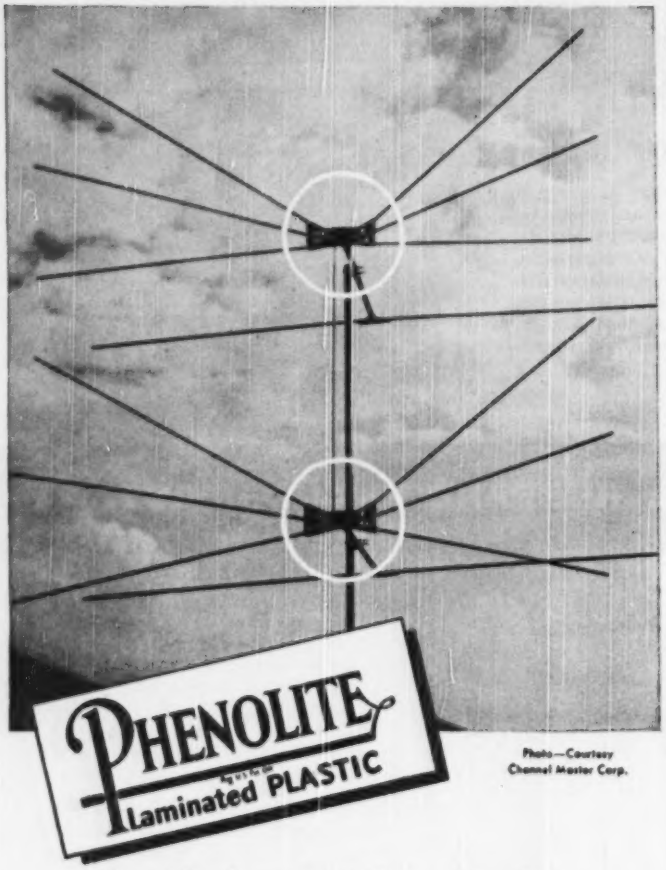
NO. 2315 COMBINATION CUTOUT

HANG THE LOAD ON HUBBARD HARDWARE

HUBBARD AND COMPANY

ESTABLISHED 1843

PITTSBURGH CHICAGO OAKLAND, CALIF.



Photo—Courtesy Channel Master Corp.

the ideal material to insulate elements of Television Antennae

In the development of television, Phenolite has played a vital role as an insulating material in antennae, TV receivers and transmitting equipment. This is due to its excellent electrical properties coupled with its ease in machining. Its low power factor at ultra-high frequencies makes it especially valuable as television and radio insulation. Because of its low moisture absorption, any variation in electrical properties is negligible, even under long exposure to high humidity—hence its value in antennae insulation. Phenolite, in addition, is light in weight with excellent machining qualities, and one of the strongest materials per unit weight known. Sheets, Rods, Tubes, Special Shapes.

National Service Engineers will, without obligation, assist you in employing Phenolite, National Vulcanized Fibre and Peerless Insulation to your best advantage.

NATIONAL VULCANIZED FIBRE CO.
WILMINGTON DELAWARE
Offices in Principal Cities
Since 1873

shock mounting, (2) redesigned D'Arsonval movement, (3) revised frame structure to secure the core against shock failure, (4) new fastening technique, (5) new hair springs, (6) laminated aluminum alloy tubing pointer, (7) new shock mounting ring, and (8) hermetic sealing. Scale lengths of 1½, 2½, and 3½ in. may be obtained with these meters.

Marion Electrical Instrument Co, Stark Street Gate, Manchester, N. H.

•

Oscillograph

RECURRENT, single, or driven sweep durations are said to be continuously variable from 5 sec to 10 microsec in the Type 250-AH cathode ray oscillograph. A Z-axis input is provided for intensity modulation. The over-all accelerating potential for the tube used is 13,500 v, allowing observation and photographing of high-speed signals recurring either at random or at slow, recurrent intervals. A built-in square-wave voltage calibrator, accurate to within plus or minus 5%, provides outputs of 0.01, 0.1, 1.0, 10 and 100 v.

Allen B. Du Mont Laboratories, Inc, Instrument Div, Clifton, N. J.

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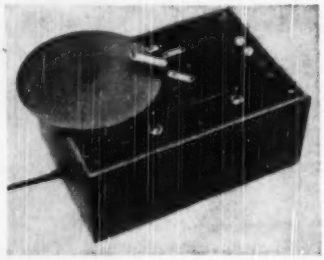


Recording Chronograph

MEASUREMENT of acceleration and velocity of extremely high speed rotating and reciprocating machinery can be accomplished with a recording chron-

MORE NEW EQUIPMENT

Just Received

Appearing Next Issue

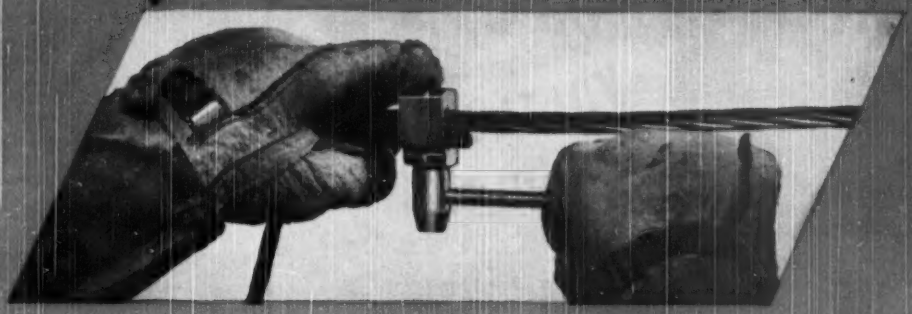
LIGHTNING ARRESTER
Similar to older horizontal type except for vertical expulsion

SERVICING PLATFORM
Truck-mounted steel boom has self-leveling platform

MEGOHMMETER
Covers the range from 30,000 ohms to 20,000,000 megohms

INSULATION TESTER
Can be used in development and control of insulating coatings

Easy to Handle



FARGO CONNECTORS*

Hold Wires Permanently!

Preferred by Linemen for their ease of installation—Fargo Connectors are built on the same principle as the ordinary bench vise . . . with the same high mechanical efficiency for converting a torsional force into a compressive one—*so they hold permanently!* They make a vibration-proof contact . . . require no attention after installation—and provide an ideal, low-resistance connection at a cost no more than other types.

. . . *"built like a vise —grips like a vise."*

EASY TO USE

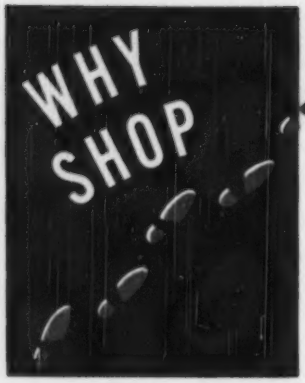
*Approved by Underwriters' Laboratories, Inc.

Fargo distribution Connectors are available in lap jaw, straight jaw, diagonal jaw and spacer-bar types. Also, there are Fargo Connectors for transmission and heavy-duty distribution installations. Your Line Material Field Engineer will be glad to give you complete details on these, as well as other time and labor saving devices in the Fargo line.

FARGO

Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie, N.Y.

Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin



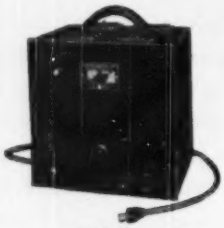
FOR VOLTAGE REGULATORS ?

THE SUPERIOR ELECTRIC COMPANY HAS A STABILINE FOR YOUR NEEDS

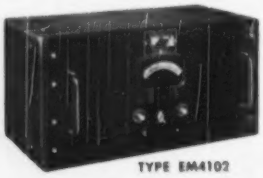
If you're looking for dependable automatic voltage regulation, investigate STABILINE first. You'll save time and money — you'll get longer service through better design and construction — you'll get performance and operating characteristics as advertised.

AVAILABLE IN 2 TYPES

STABILINE Type IE is instantaneous and completely electronic in action. Keeps output voltage to within ±0.1% of preset value regardless of wide line variations; to within ±0.15% regardless of load current or power factor changes. Waveform distortion *never* exceeds 5%. STABILINE Type IE is available in cabinet or rack mounting models — in numerous ratings.



TYPE IE
PORTABLE



TYPE EM4102

STABILINE Type EM (Electromechanical) features zero waveform distortion, insensitivity to magnitude and power factor of load, no effect on system power factor; no critical adjustments. It is available in output ratings up to 100 KVA — for single and for 3 phase operation.

STABILINE Types IE and EM perform "as advertised". Each and every STABILINE Automatic Voltage Regulator is inspected and tested to the most rigid specifications. If — after you purchase a model of either type — you would like a copy of the inspection and test report, write us and a full report will be sent promptly.

WRITE US TODAY FOR FURTHER DETAILS ON THE STABILINES

1302 Meadow St.,
BRISTOL,
CONN.

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT

POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS

ograph. It will measure and record time intervals from 0 to 0.033 sec. A precision synchronous motor drives a circular chart at 1,800 rpm. Into this chart a perforation is burned when an electrical circuit is broken. Two of these marking circuits are provided to indicate the relative difference in time between two positions of a moving object. Just one of the circuits can be used with rotating members to repeatedly make and break contact, indicating the time rate of position. The chart is read by means of a scale marked in milliseconds.

Theodore M. Long, 40 S. Bridge St, Somerville, N. J.

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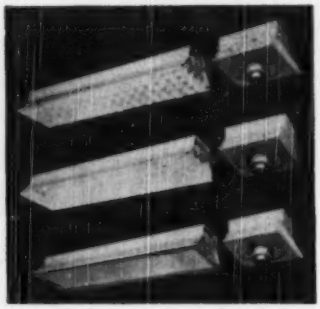


Luminaire with Spotlight

THE SHALLOW DESIGN feature of the Type TS troffer fluorescent luminaire with incandescent spotlighting requires only 7¾ in. above the finished ceiling. Three types of shielding are available: Louver, plain ribbed glass, and prismatic lens. All of them hinge to the basic housing and are interchangeable. Housings are supplied in 4-ft lengths for 2 or 3-lamp models.

Type SR-150 companion swiveling incandescent spotlight unit is designed for use as an individual recessed unit, or within rows or groups of TS troffers. It utilizes a 150-w PAR projector lamp and is shielded by a concentric ring louver.

Westinghouse Electric Corp, P.O. Box 2099, Pittsburgh 30, Pa.

•

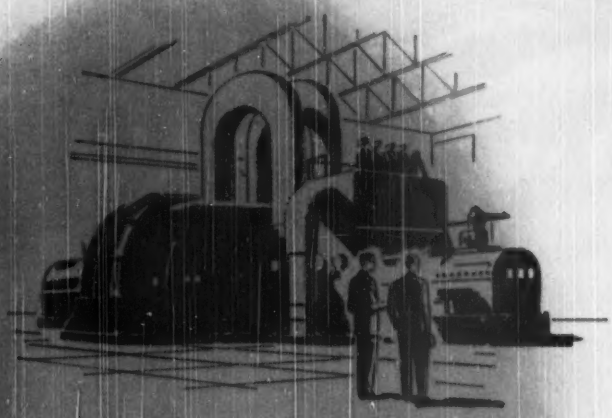
Motor Kit

ALL PARTS FOR A MOTOR of 1/6, 1/6, ¼ or ⅓ hp, together with a manual of instructions, comprise the Electric Motor Kit. The kit may be used by utilities, particularly rural utilities, in familiarizing both teen-agers and adults with the construction and functioning of a fractional horsepower ac motor.

The manual offers an explanation to the layman of some commonly used elementary electrical terms and step-by-step instructions for winding the stator

Today it's Roebling!

There are more than 40 standard types in Roebling's line of electrical wires and cables. From copper conductors to protective jackets, they are made entirely in Roebling plants. Special techniques and the most modern, precision machines assure quality products, unsurpassed for service and economy.



for V. C. Cable with superior heat resistance

WHEREVER CIRCUITS heat up, you'll get new measures of dependability . . . save both time and money . . . with Roebling Varnished Cambric Cable! It has extreme resistance to heat and is your A-1 specification for leads for generators, transformers, motors and oil switches.

Roebling Varnished Cambric Cable is made in single and multiple conductor types—single, from 2,000,000 C. M. to No. 14 A.W.G.—multiple from 500,000 to No. 14 A.W.G. Both constructions are adapted for use up to 17,000 volts between phases for unshielded multiple conductor . . . up to 21,000 volts between phases for single conductor and shielded cables on ungrounded neutral systems . . . up to 28,000 volts between phases for single conductor and shielded cables on grounded neutral systems.

Write for complete information, or call on your Roebling Distributor for help in choosing the best cables for your requirements. John A. Roebling's Sons Company, Trenton 2, New Jersey.

ROEBLING *A CENTURY OF CONFIDENCE*

Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Road ★ *Cincinnati*, 3253 Fredonia Ave. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 4801 Jackson St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. Twelfth St. ★ *Portland*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 Seventeenth St. ★ *Seattle*, 900 First Ave. S.

JOHN A. ROEBLING'S SONS COMPANY, TRENTON 2, NEW JERSEY

Midnight snack that pays off in pork chops

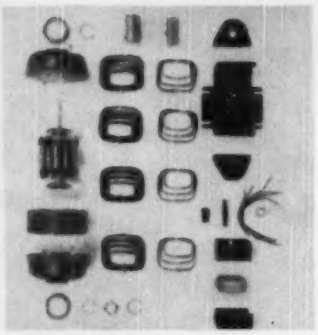
FEED hogs at midnight?—One farmer does, and finds it pays. He fills troughs, then wakens swine with floodlights. Soon they are greedily enjoying their "snack." When lights go out, the animals retire—to grow pork chops while they sleep! Odd?—Perhaps; but this is one more example of the uses for electricity on the farm!

With rural electrification, comes the need for efficient pole-line insulation. Hemingray Power Insulators have answered this need with complete dependability.

No. 680 for 15,000 volt lines. The technical standards committee of the Rural Electrification Administration has approved Hemingray Insulators No. 670, No. 680 and No. 514 under the limits of AIEE Specification No. 41-1944 for use on REA lines.

HEMINGRAY
POWER INSULATORS

American Structural Products Company
Muncie, Indiana
Subsidiary of Owens-Illinois Glass Company



and assembling the motor. The only tools required for the project are said to be screw drivers, hammer, fibreboard, knife, and a nail.

P. C. Wright, 1210 Myrtle Ave, Takoma Park, Md.

•

Portable Voltmeter

AN expanded scale centered on the common 110 and 220 line voltage mark is featured by a new model of the Mini-Volt voltmeter, Model 410A. According to the manufacturer, it is accurate to within 2 v at 110 v ac, and glow-lamp indicator may be used for a minimum of 25,000 hr. The 12-in. flexible test leads are tipped with heavily insulated test prods. The meter will check voltage, indicate whether ac or dc, check for continuity, check for blown fuses, warn of live wires, and locate grounded components.

Industrial Devices, Inc, Edgewater, N. J.

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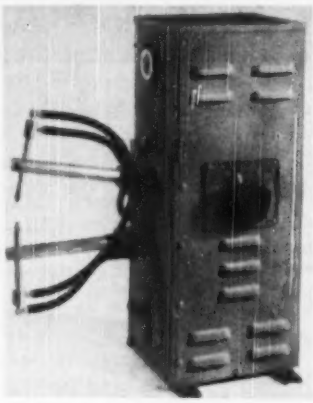

SPOT WELDER—Watercooled electrodes and secondary coil and capacity of two pieces of 16-gage cold rolled steel are features of the 4.6-kva Model 130T spot welder with electronic timer. Operation is at 220 v, 1-ph, through a 60-amp switch

Birdsell Products, P. O. Box 733, Los Altos, Calif.

Plug-in Strip

IN ADDITION to providing a spread of electrical outlets at either 6 in. or 8 in. intervals, the new Type CF2-G multi-outlet assembly permits plugging in grounded or ungrounded portable electrical equipment in every receptacle. Beneath the third slot in each receptacle is a copper insert that is mounted to the multi-outlet's steel base for grounding purposes.

The strip has a 24-gage steel channel enclosing the receptacle harness of two No. 12 insulated conductors. Installation is made by joining 6-ft standard lengths of the strip.

National Electric Products Corp, Chamber of Commerce Bldg. Pittsburgh 19, Pa.

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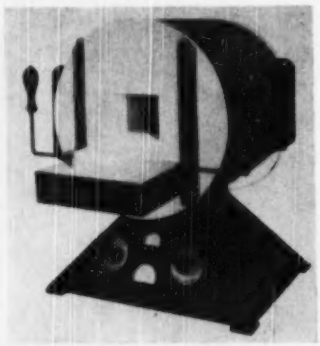

Electric Furnace

MANUAL CONTROL of a 3,500-w electric muffle furnace, designed for an operating range of 1,700 to 2,600 F, is provided by a tap-changing transformer mounted in the furnace base. Use of the tap-changing transformer is said to avoid on-off control, adding to the life of the heating elements.

Standard equipment includes an ammeter and an indicating pyrometer. Inside dimensions of the laboratory test furnaces are 4¼x3x7 in. long. They are available for operation at 115 v or 230 v, 60 c.

Hevi Duty Electric Co, Laboratory Furnace Div, Milwaukee 1, Wis.

•

Liquid-Level Indicator

AN electronic finder of the Levlocator seeks out the level of the liquid in a manometer tube, tank or other vessel. The mechanism which operates the finder also operates the direct-reading indicator which can show the amount of liquid in the vessel about a preselected datum point, usually the bottom of the tank. Tank level is obtained by operating a push button on the instrument; the reading then ap-

ON TV FOR G.E.

EVERY SUNDAY NIGHT

FRED WARING

AND HIS PENNSYLVANIANS

A lamp commercial each week.

ONE MORE REASON WHY

G-E LAMPS SELL ON SIGHT!

You can put your confidence in—

GENERAL ELECTRIC

They'll tell you that... although most tapes look alike, there is a big difference — in quality and in workability. Men who work with tape know from experience that Accurate Tapes have the proper tackiness for fast, easy application, that it wraps tight and stays tight, will not ravel and tears off clean.

As for performance qualities, Accurate Tapes have high dielectric and tensile strength, superior aging qualities and are backed by 30 years of specialized experience in tape manufacture. It's important to note, too, that every foot of Accurate Specification Tape exceeds ASTM standards by a wide margin. Specify Accurate on your next tape order — it's the sure way to guarantee quality.

WAREHOUSE STOCKS and representatives strategically located for prompt, efficient service from coast to coast. Write for name of representative nearest you and illustrated catalog — just address ACCURATE MANUFACTURING COMPANY, GARFIELD, NEW JERSEY.

ACCURATE ASTM FRICTION TAPE exceeds all requirements of ASTM designation: D69-48T.

ACCURATE ASTM RUBBER TAPE exceeds all requirements of ASTM designation: D119-48T.

ACCURATE TAPE

pears automatically in the indicator.

When used as a manometric type instrument, it is claimed to have the same sensitivity and accuracy (reads to 0.01 in. of the level in tank when direct-reading) as the direct-reading unit. Further details are given in Bulletins 101 and 102.

Asch Equipment Co, 98-11 Queens Blvd, Forest Hills, N. Y.

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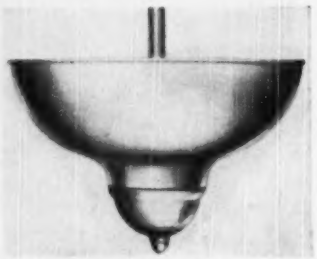


Island Light

MULTIPLE socket arrangement of a mushroom type island light for area lighting accommodates three 200-w lamps, base up. The unit is said to be particularly adaptable for low mounting heights as it has a detachable cast dome for making connections. In the dome are three ½-in. tapped openings for mounting flood or spot lampholders. Size is 20 in., finished in either porcelain or ultranamel and provided with ¾-in. riser and slip fitter for 2-in. pipe.

Steber Manufacturing Co, 2700 Roosevelt Rd, Broadview, Ill.

MORE NEW PRODUCTS about which you should know

ALLEN-BRADLEY CO, MILWAUKEE, WIS., has designed a **timer** for a-c or d-c with range adjustable from 10 cycles to 3 min and instantaneous relay resetting . . . CHATHAM ELECTRONICS CORP 475 WASHINGTON ST, NEWARK 2, N. J., is manufacturing a regulated d-c **power supply**, Model EA-50A, for laboratory use where an output of 0-500 v is required; operates from 105-125 v, 60 cycles.

THE CONNECTICUT HARD RUBBER CO, 407 EAST ST, NEW HAVEN, CONN., has developed Cohrlastic **mountings** of silicone rubber to dampen vibration; temperature range is from —100 F to 500 F . . . GENERAL ELECTRIC CO, CONSTRUCTION MATERIALS DEPT, BRIDGEPORT 2, CONN., has announced a new type **grounding outlet** and plug for use where codes require grounding of 125-v

PLAN YOUR SPRAYING PROGRAM Around...

ESTERON
BRUSH KILLER

ESTERON 44

ESTERON 245

SODIUM TCA
90%

ESTERON BRUSH KILLER containing equal amounts of esters of 2,4-D and 2,4,5-T acid, controls woody and herbaceous plants including alder, birch, brambles, cherry, elm, hickory, oaks, osage orange, poison ivy, sumac, willow, and many other species. Assures satisfactory control of most troublesome species on the average right-of-way. Also effective in treating stubs and stumps.

ESTERON 245 controls woody plants in the same manner as Esteron Brush Killer. It is particularly effective on 2,4-D resistant species such as brambles, hawthorn, mesquite, osage orange and poison ivy. Also very promising for stump treatment and dormant bark application.

ESTERON 44 is effective against most herbaceous weeds and will also control woody species such as willow, sumac and birch.

SODIUM TCA 90% controls such grasses as Johnson, Quack and Bermuda plus other annual and perennial grasses growing around substations and in pole yards. At lower dosages, it retards growth without killing, where a light grass cover is desired.

You will find it profitable to plan your spraying program around these outstanding developments of Dow research—Esteron Brush Killer, Esteron 44, Esteron 245 and Sodium TCA 90%. Used separately or in conjunction, they can help you maintain a right-of-way substantially free from weeds, woody growths and noxious grasses.

These effective products have been developed by Dow, major producer of effective herbicides—and *tested and proved* by Dow in cooperation with public utilities. Dow sales and technical men are available for consultation and assistance on your right-of-way control problems. Write Dept. 656, The Dow Chemical Company, Midland, Michigan.

Ask your dealer about these result-getting weed and grass killers.

Agricultural Chemical Division

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

USE DEPENDABLE DOW AGRICULTURAL CHEMICAL PRODUCTS

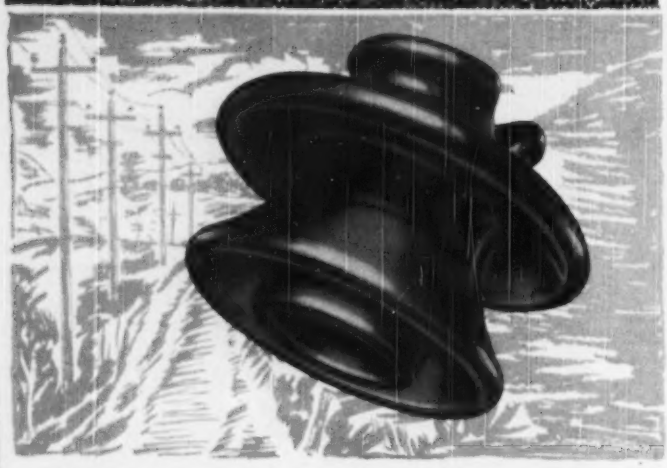
WEED AND GRASS KILLERS • INSECTICIDES • FUNGICIDES
SEED PROTECTANT • PLANT GROWTH REGULATORS
GRAIN AND SOIL FUMIGANTS • WOOD PRESERVATIVE

DOW

CHEMICALS

INDISPENSABLE TO INDUSTRY AND AGRICULTURE

RIGHT *for the* JOB . . . RIGHT ON THE JOB!



To Meet Today's and Tomorrow's Higher Distribution Voltage Needs

More and more companies are using Pinco L 1123's for raising insulation levels on present 6900 and 7200 volt lines and are designing new lines for convenient increase in future operating voltages.

B.I.L. levels require 23 KV lines to have impulse values of 150 KV. The L 1123 one-piece Pin Type meets this requirement perfectly as scores of utilities have discovered. For here is an insulator which will not only meet stepped-up line loads in years to come but will keep maintenance and replacement costs at an absolute minimum.

So when you put up new lines or step up present ones . . . *put up PINCO to be sure!*

★ The Porcelain Insulator Corporation
761 Main Street, Lima, N. Y.

Sales Agents: JOSLYN MFG. & SUPPLY CO.
Offices in Principal Cities

PINCO INSULATORS

Suspension Insulators . . . Switch and Bus Insulators . . . Distribution Clamps . . . Distribution Pin Types and Guy Strains . . . Transmission Line Fittings . . . Tree Insulators . . . Transformer and Circuit Breaker Bushings . . . One Piece and Multi-part High Voltage Pin Types . . . Suspension and Strain Clamps . . . Indoor Bus Support Porcelain . . . Lightning Arrester Porcelain

• 1920 Thirty Years Service to the Electrical Industry 1950 •

single-phase or 115-v dc, portable electrical equipment.

The Hart Mfg Co, 110 Bartholomew Ave, Hartford Conn., offers a series of small rotary **switches** for use with air conditioning and ventilating equipment, rangettes, etc. Ratings are 15 amp, 125 v; 7.5 amp, 250 v a-c. . . . The Dampney Co of America, Hyde Park, Boston 36, Mass., has added a heat (750 F) and weather-resistant **protective coating** to its line called silicone coating aluminum; recommended for boilers, furnaces, stacks, ovens.

Cambridge Thermionic Corp, 445 Concord Ave, Cambridge 38, Mass., has developed two ceramic **coil forms**, LS-5 and LS-6, available with high, medium, or low frequency slugs; details in Catalog 300. . . . The Hinde & Dauch Paper Co, Sandusky, Ohio, has designed a special corrugated shipping **box** for fluorescent light fixtures; is said to cut packing time to about 70 sec per unit.

General Electric Co, Nela Park, Cleveland 12, Ohio, has introduced a 300-w R-40 reflector **spot lamp** with a 5-in. diam face; it reportedly provides a small spot of light brighter and for longer distances than is obtainable with a flood lamp. . . . G. E. Co, Schenectady 5, N. Y., has an arc-welding **electrode**, the W-22 (AWS Class E 6010), intended for vertical and overhead welding of joints in mild steel.

American Instrument Co, Inc, 8030-50 Georgia Ave, Silver Spring, Md., is marketing a **Magne-Gage** for measuring by magnetic means the thickness of nickel coatings on iron or steel in the range of 0.001 to 0.0045 in. . . . The Metal Marker Mfg Co, 1378 E. 40th St, Cleveland 3, Ohio, has announced availability of **metal tags** said to facilitate permanent identification or coding of electrical wiring, marking utility poles, labeling inventory, subassemblies, steel stocks, and fabricated products. They are made from aluminum, brass, steel, Monel, zinc, tin-plate, etc.

Sylvania Electric Products, Inc, 60 Boston St, Salem, Mass., has announced a 300-w weatherproof incandescent **reflector lamp** suitable for outdoor use in factory yards, sports areas and gardens, signs, and roadside stands; operation is from 115, 120 and 125 v. . . . Ace Laboratories, 161-18 Coutant Ave, Lakewood 7, Ohio, has a new rust-inhibitive, **protective-coating** compound for structural steel and construction equipment; its dielectric strength is said to make it suitable for insulating and exterior surface-finishing of motors and other machinery and controls.

Cables run COOLER... in TRANSITE DUCTS

... reducing copper losses

... increasing current capacity

... prolonging insulation life

HERE'S HOW to reduce copper losses ... increase current carrying capacity ... and prolong insulation life—run your cables in Transite* Ducts.

Current carrying capacities can be increased in a typical duct bank as much as 5%, or I^2R losses can be reduced 11%, for cables located in Transite as compared with other ducts used for power circuits.

And, Transite Ducts assure permanent duct banks because Transite is incombustible; is immune to rust and rot; is unaffected by electrolysis; will not slag under action of an arc, and will retain its high original strength.

An unusually smooth bore assures no injury to cable sheath, either in natural movement under load, or when pulling-in cables. Long, lightweight lengths can be quickly and economically installed.

In addition, a full line of fittings simplifies even the most complicated of installations.

For full information on Transite Ducts, write for Data Book DS-410. Johns-Manville, Box 290, New York 16, N. Y.

*Reg. U. S. Pat. Off.

How Transite Ducts increase current carrying capacities

Type cable 3 cdr. 500 MCM Compack Sector, 15 KV (6th Edition AEIC Spec.)
No. of cables—3 (all loaded in one bank)
Daily Load Factor—75%

Earth Temp. ambient—20 C	Transite	Other
Total Therm. Res. to Dielectric Loss (C watts/ft.)	5.66	6.17
Total Therm. Res. to Copper Loss (C watts/ft.)	4.44	4.95
Temp. Rise from Dielectric Loss (C)	1.9	2.1
Allowable Rise for Copper Loss (C)	59.1	58.9
Allowable Watts per ft. cable	4.44	3.96
Allowable Current—(Amps. per cdr.)	386.	365
Allowable Current—(Relative %)	105.6	100.

Johns-Manville *Transite Ducts* "KORDUCT"— for encasement in concrete

"CONDUIT"— for use exposed and underground without encasement

NEWS ABOUT PEOPLE

Exide Makes Norberg Executive Vice-President

Carl F. Norberg, vice-president in charge of manufacturing for Electric Storage Battery Co since 1944, has

CARL F. NORBERG

been elected executive vice-president. He has been a director since 1948.

A native of Sweden and graduate of the Royal Institute of Technology in Stockholm, Norberg came to this country in 1925. He started as a laboratory assistant with Willard Storage Battery Co, Cleveland, an Electric Storage Battery subsidiary. Later he was in charge of engineering at Willard Storage Battery Co of Canada, Ltd; works manager and chief engineer for Willard Storage Battery Co of California; and vice-president in charge of manufacturing with the Cleveland company.

Norberg joined Exide's executive department in Philadelphia in 1943. In 1947 he was elected a vice-president and director of Stokes Molded Products, Inc, another subsidiary. He is a member of the American Chemical Society, Society of Automotive Engineers, Society for Advancement in Management, Franklin Institute, and American Ordnance Association.

•

Charles Dunn has been appointed manager of the Lower Columbia district of Bonneville Power Administration, with headquarters at the J. D. Ross substation in Vancouver, Wash. He has been district engineer since 1947 and acting manager since September, when **O. G. Hittle** resigned to become manager of the Cowlitz County Public Utility District. Before joining BPA in 1938 Dunn worked for Commonwealth Edison Co and Public Service Co of Northern Illinois, Chicago, and Central Arizona Light & Power Co, Phoenix, Ariz.

•

Duquesne Light Co Fills Industrial Sales Posts

Duquesne Light Co, Pittsburgh, has made three new appointments in its industrial sales department. R. R. Johnson has been named director of industrial sales; David W. Loucks, director of industrial sales and steam sales; and John W. O'Nan, supervisor of industrial sales.

Johnson, who has been supervisor of industrial sales, succeeds R. W. Heller, who recently became manager of residential sales. Johnson joined the company in 1925 as an engineer in the customers' relations section and later served as supervisor of customers' engineering section and industrial salesman. A registered professional engineer, he is a member of the Engineers' Society of Western Pennsylvania, Association of Iron and Steel Engineers, and Electric League of Western Pennsylvania.

Loucks became a power sales engineer for Duquesne Light in 1926 and has since served as power and steam sales engineer and supervisor of industrial electric and steam sales. He is president of the National District Heating Association and a member of the Engineers' Society of Western Pennsylvania.

O'Nan, also a member of the Engineers' Society, returned to the company in December after a year on loan to the Pittsburgh Industrial Development Council as executive director.

•

J. Sterling Davis has been elected treasurer and a member of the board of directors of National Electric Products Corp, Pittsburgh, to succeed **H. H. Robinson**, who retired last year. Davis spent 13 years with Commonwealth Edison Co, Chicago, ending as assistant to the comptroller, before joining American Barge Lines Co, Louisville, Ky., in 1941.

Davidson Vice-President of Pennsylvania P&L

John S. Davidson, manager of Pennsylvania Power & Light Co's Harrisburg division since last Septem-

J. S. DAVIDSON

ber, has been named a vice-president. He succeeds D. A. Elias, who has retired as Harrisburg division vice-president after 26 years with the company.

Davidson started in 1931 with Nebraska Power Co at Omaha. There he served in the power plant and merchandising and commercial sales departments.

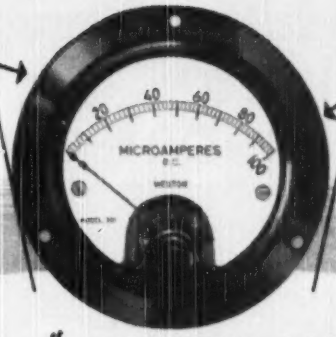
In 1937 he joined Pennsylvania P&L as assistant in the vice-president's office at Allentown. He was Allentown district manager from 1938 to 1940 and then spent nine years as Hazleton division manager.

Davidson is a son of the late J. E. Davidson, who was general manager of Omaha Public Power District.

•

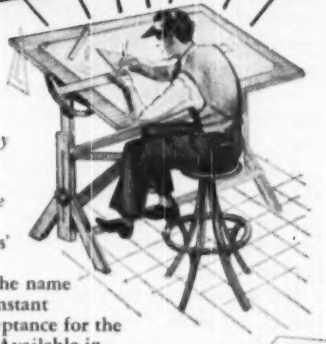
Chris C. Beck has been elected president of Central Lincoln Peoples Utility District, Newport, Ore., to succeed **Andy Naterlin**, who will continue as director. **Millard Martin** was elected vice-president, and **Larry Hull** was renamed treasurer.

H. R. Koch has resigned as vice-president, secretary, and director of W. W. Matthews Corp, St. Louis, to devote his full time to the operation of the H. R. Koch Co, manufacturers of thermoplastic products. Koch joined Matthews



"Built-in" OPERATING ASSURANCE

FOR BUILDERS OF ELECTRIFIED EQUIPMENT!



Nowhere does WESTON *dependability* and *value* pay bigger returns than on the panels or controls of electrical equipment. By consistently *telling the truth*, they help assure efficient performance of the equipment in users' hands . . . where *so much* depends on instrument performance. Moreover, the name WESTON on a panel instrument gains instant recognition . . . helps build buyer acceptance for the products on which they are installed. Available in types, sizes, ranges and styles for all needs. Ask your nearest WESTON representative for all the facts, or write for bulletin A-7-B. WESTON Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark 5, New Jersey.

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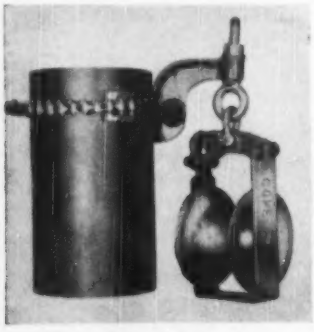
THE T. J. Cope INC. REPORTER

Written by Edgar W. Baird, Jr., President T. J. Cope, Inc., Philadelphia, Pennsylvania

The words: *satisfaction, quality* and *savings* are ever present in the minds of discerning buyers and users of tools and equipment. That's why I wish to call your attention to the new Cope Stringing Sheave—a sheave that will do a bang-up job for you in aerial cable installations!

You will readily see from the description below that the unusual ease with which it can be used is bound to satisfy the men in the field. All materials (including the malleable sheave) were carefully selected to withstand hard usage. Such features—when added to low cost—naturally spell s-a-v-i-n-g-s.

The Cope Stringing Sheave is for use in installing aerial cable up to 3¼". The sheave—made of malleable iron to withstand all possible wear—is 7" in diameter. It contains an oilite bushing for smooth operation and life lubrication.



The whole unit, weighing only thirty pounds, can be positioned by one man. For easier installation, bracket assembly can be readily removed from sheave assembly by unscrewing pin in the clevis. Special link chain permits greatest possible grip and stays in position. The same wrench will tighten chain and adjust height of the sheave.

The Cope Stringing Sheave has the distinctive feature of eliminating lifting of cable for clamping to the pole from a lower, awkward position. The bracket is mounted at an angle with line of pull, so that the cable clears the pole by about one inch in direct line with the clamp. *After* clamping the cable, the sheave assembly is lowered to remove load, so that the latch on cast steel yoke can be easily opened.

In addition to the Stringing Sheave for pole mounting, Cope has (1) a *Cross-arm Sheave* and (2) an *Angle Cross-arm Sheave* that can be readily adjusted up to ninety degrees. The latter was specially designed to meet the requirements of one of our customers—another indication of the type of service we like to render each of you.

If it is your desire to do quicker and better aerial cable installations at lower cost, then these Cope sheaves are a *must* on your program.

May we therefore have the pleasure of supplying your needs or answering any questions you may have?

Sincerely,

E. W. Baird Jr.

T. J. COPE, Inc.

711 S. 50 St. Philadelphia, Pa.

in 1925 and served as auditor until 1938, when he was made secretary. He has been a vice-president since 1948.

•

GE Makes Appointments at Pittsfield, Schenectady

Robert S. Neblett, assistant general manager of General Electric Co's nucleonics department, has been appointed business and construction manager of the Knolls Atomic Power Laboratory at Schenectady, N. Y.

GE also has made several new appointments in its transformer and allied product divisions at Pittsfield, Mass. **Max I. Alimansky,** engineer of the capacitor divisions, has been made assistant to the manager of engineering. **Merritt E. Scoville,** formerly assistant engineer, will succeed Alimansky.

New manager of the distribution transformer sales division is **Clement E. Sutton, Jr.** His former position as manager of the power transformer sales division is now held by **John W. Butler,** formerly manager of the commercial engineering division. A new general service division has been formed to consolidate order service, statistical, and office services for the sales divisions, with **Howard R. Humphrey,** former administrative assistant to the manager of sales, as manager. **Harold M. Jalonack,** formerly manager of sales planning, becomes manager of the marketing and promotional service division.

Neblett will handle business and contractual relations between the laboratory and the Atomic Energy Commission and with outside contractors and other GE departments. He joined the company's test course in 1923. Among positions he has held are assistant manager of the turbine division of the apparatus department, manager of the federal and marine divisions, and administrator of the nucleonics project. When the nucleonics department was formed in 1948 to operate the AEC plant at Hanford, Wash., he was named assistant general manager.

Alimansky, with GE since 1926, was appointed capacitor sales manager in 1932 and division engineer of the capacitor engineering division in 1933.

Scoville, with GE since 1930, has been section engineer of the large capacitor section since 1946. A fellow of AIEE, he served as chairman of the Pittsfield section in 1945-6. Sutton joined the company in 1934. After holding positions in Schenectady and Philadelphia he was made assistant manager of the power transformer sales division in 1948 and manager in 1949.

Butler, a fellow of AIEE, joined GE on test in 1926 and the transformer and allied product divisions in 1945. Hum-

HUSKY

ROYAL'S TILTING INSULATOR . . .

SWITCH-TYPE AL . . . .

In all current ratings from 200 to 1200 amp. this switch is a giant in ability both in substations or on transmission lines. It is designed in strict accordance with the high standards set and maintained by Royal engineers.

It is way ahead of its price in value. Simple design throughout, with a number of Royal Patented features, well proved in the field of performance, in hundreds of installations. These include Utilities, Industrials, and R. E. A.

Built in voltage ratings up to and including 46 kv. The Type AL disconnect switch is described fully on pages 145 to 148, and the air break design on pages 161 to 164 of our Catalog No. 11.

SELF-CLEANING CONTACTS

Multiple-finger, individually self-aligning, high-pressure point contacts of an exclusive design. In closing, the fingers engage the narrow axis of an elliptical cam. As the switch moves into operating position the fingers are spread to the wide axis of the cam, wiping the contact and developing high pressure contact.

CONSTRUCTION DETAILS

Standard Nema 3-in. bolt-circle insulators eliminate off-size insulators in your system. Braid jumpers are tinned copper, supported by a galvanized steel pantograph. Current carrying parts are of high conductivity, non-ferrous material. The steel tilting carriage will accommodate either a square steel or a full-size 2x4" wood interphase shaft. There is a silver-to-silver connection at the hinge end of the braid. The tilting insulator stops firmly and positively in both open and closed positions. There are no adjusting stops to position in the field.

35 YEARS
A Part of the Record of
AMERICAN POWER PRODUCTION

Royal ELECTRIC MANUFACTURING COMPANY INCORPORATED
1122 EAST 87TH STREET *Chicago 19, Ill.*
Designers and Manufacturers of Power Switching Equipment and Special Electrical Devices

MR. ENGINEER: Can you answer these questions

About your present or future transformer oil reconditioning equipment . . . .

- Does it remove volatile corrosive acids, gases, dissolved moisture and solids?
- Is it a closed system with **no aeration of the oil** in order to keep out air —oil's worst enemy?
- After reconditioning, does the oil surpass its original insulating values?
- Does it recondition oils while transformers and circuit breakers are fully energized?
- Is it fully automatic?
- Is it protected by automatic safety devices?
- Is it suitable for stationary or portable use?
- Is the oil heated and then atomized in a high vacuum to separate deteriorating elements from the oil?
- Is there complete absence of high speed, delicately balanced moving parts?
- Has necessity for frequent cleaning been eliminated?

BOWSER HYDRO-VOLIFIER

With this exclusive Bowser process, all of the above 10 questions are answered "YES."

Oil dielectric is restored to 35 k.v. in a single pass for less than a cent a gallon!

If there's an economy drive on in your plant, you'll want complete details NOW.

Write today for these **FACTS** *on insulating oil reconditioning*

PORTABLE HYDRO-VOLIFIER

BOWSER, INC., 1384 Creighton Ave., Fort Wayne 2, Indiana

Manufactured and Sold in Canada by
S. F. BOWSER COMPANY, LTD., HAMILTON, CANADA

LIQUID CONTROL SPECIALISTS SINCE 1885

phrey has been with GE since 1910, when he joined the transformer engineering division. Jalonack, who won the Charles Coffin award in 1931, joined GE in 1917.

•

Doherty General Manager of Niagara Falls Power

Francis X. Doherty, former assistant vice-president of Buffalo Niagara Electric Corp, has been elected vice-president and general manager of Niagara Falls Power Co. He will assume the duties of Gustav F. Watters, who will continue as a vice-president and director but will move to Buffalo to serve as vice-president of the newly formed Niagara Mohawk Power Corp.

FRANCIS X. DOHERTY

Doherty has been associated with western New York companies of the Niagara Hudson system for more than 20 years. In 1933 he became treasurer of Bradford (Pa.) Electric Co, a utility then affiliated with the predecessor companies of Buffalo Niagara. Before being made an executive of the latter company he was district manager of the Avon district and a budget director of the western division companies.

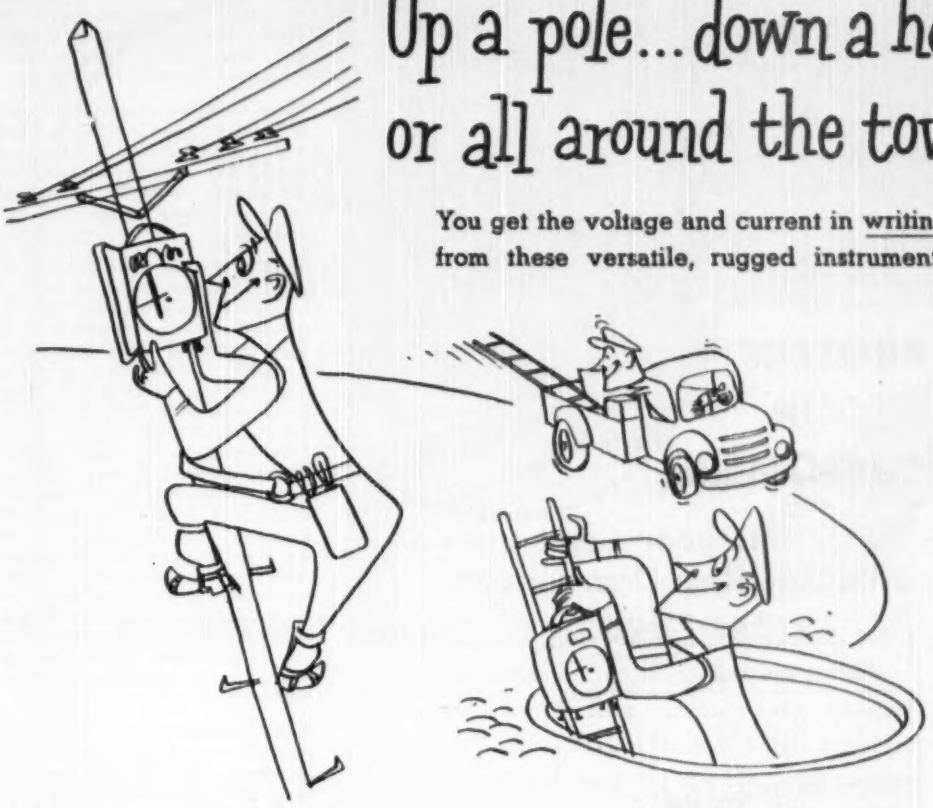
Watters will become the immediate assistant to Albert T. O'Neill, Niagara Falls Power president, in the administrative affairs of Niagara Mohawk's western division and its subsidiaries, Niagara Falls Power and Canadian Niagara Power Co. Ltd.

•

Ivanhoe H. Sclater, consulting engineer of the Power Transformer Engineering Division of General Electric Co, has retired after 44 years of service. Sclater, who is credited with 10 patents, joined GE's Lynn Works in the testing department in 1905. He had worked on design of constant current, distribution, oil-filled instrument, small power, and high-voltage instrument transformers and street lighting before becoming di-

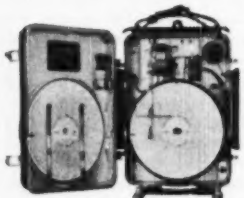
Up a pole... down a hole or all around the town

You get the voltage and current in writing from these versatile, rugged instruments



Bristol All-Purpose Recording Voltmeters and Ammeters

Lightweight and self-contained . . . all parts built for rough handling



For the most efficient operation of your electrical system, keep an eye on voltage and current.

Knowing the facts — accurate, complete, clear—you can make the necessary corrections.

Bristol's All-Purpose Recorders —with weather-proof case and light weight—handle a great variety of work . . . pole-mounted, wall-mounted (ideal for damp cellars and manholes), permanently mounted—or portable. 1, 2 or 3 pen types.

In stock for immediate delivery.

Write for Bulletin E1100. THE BRISTOL COMPANY, 116 Bristol Rd., Waterbury 20, Conn.

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Gives You the FACTS

When and Where You Want Them

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

PROTECT YOUR CUSTOMERS

As well as your Company when doing Line Clearance work.

LINE clearance should be done without ruthless abandon and lack of concern for unnecessary destruction. Trees which form a beautiful home setting do not have to be hacked indiscriminately. Your customer gains, and you gain good will, thereby increasing good public relations.

IT'S so easy to avoid trouble; make sure your work is done by men who appreciate *the beauty and value of trees, and who* know how *to clear lines without destroying beauty. The Bartlett Way protects you and your customers. Call our local office today.*

BARTLETT SERVICE MEANS

- CLOSE SUPERVISION
- TRAINED MEN
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BARTLETT
TREE EXPERTS

The Bartlett Way

HOME OFFICE: RESEARCH LABORATORIES & EXPERIMENTAL GROUNDS, STAMFORD, CONN.

LOCAL OFFICES: Rutland, Windsor, Vt.; Milford, Peterboro, Rochester, N. H.; Cambridge, Framingham, Manchester, Osterville, Pittsfield, Mass.; Providence, R. I.; Granbury, Hartford, New Canaan, New Haven, Stamford, Westport, Conn.; Islip, Kingston, Monroe, Middletown, New York, Peekskill, Southampton, Syracuse, Westbury, White Plains, N. Y.; Bernardsville, Morristown, Orange, N. J.; Chambersburg, Paoli, Philadelphia (Cynwyd), York, Pa.; Wilmington, Del.; Bethesda, Easton, Towson, Md.; Ashland, Ky.; Lancaster, Portsmouth, Ohio; Charlottesville, Lynchburg, Roanoke, Va.; Bluefield, Charleston, Huntington, W. Va.; Kingsport, Tenn.

vision engineer of the Power Transformer Division in 1933. In 1938 he was made managing engineer of the division and in 1947 consulting engineer. He is a fellow of the American Institute of Electrical Engineers.

Walter G. Heren, advertising manager of Union Electric Co of Missouri, has been appointed director of advertising and public relations for the Union Electric System. **James W. Lumpp,** assistant advertising manager, will succeed Heren.

Frank V. Magalhaes has retired as assistant to the chairman of the board of Consolidated Edison Co, New York. He will continue as secretary-treasurer of the Association of Edison Illuminating Companies. Magalhaes first joined New York Edison Co in 1898. After being vice-president of Hall Electric Heating Co, Philadelphia, and working at the Lynn, Mass., plant of General Electric Co, he returned to Edison in 1934 to serve as assistant to the vice-president in charge of commercial relations and later assistant to the president. A fellow of the American Institute of Electrical Engineers, he was vice-president and secretary of the United States National Committee, International Electrotechnical Commission, for several years and was a member of the American delegation to its Geneva conference in 1922.

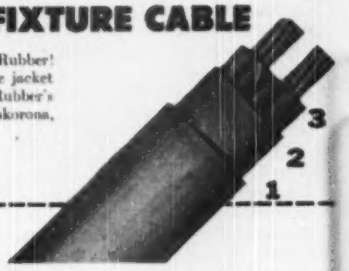
Nicholas Delaney has been named to the newly created post of manager of construction materials sales for Line Material Co, Milwaukee. He has been sales manager for the company's Kyle Products plant since 1947 and before that spent 17 years in engineering work with utilities in California and Michigan. **Richard Kirk,** apparatus engineer for the south central sales division, succeeds Delaney. Kirk has worked for several large electrical manufacturers and the Virginia-Carolina Utility Committee and has taught mathematics and engineering at South Carolina State College.

C. D. Olds has been appointed superintendent of light and power for the Northern division of Puget Sound Power & Light Co at Bellingham, Wash., to succeed **A. C. Riggs,** who has retired after 44 years with the company. Olds, an engineering graduate of the University of Idaho, began work in 1910 at Bellingham as a wireman with the Whatcom County Railway, Light & Power Co, a predecessor of Puget Power. He had been assistant superintendent of light and power for the division since 1930. Riggs was a general foreman and superintendent of line construction at Seattle before taking the division post in 1925.

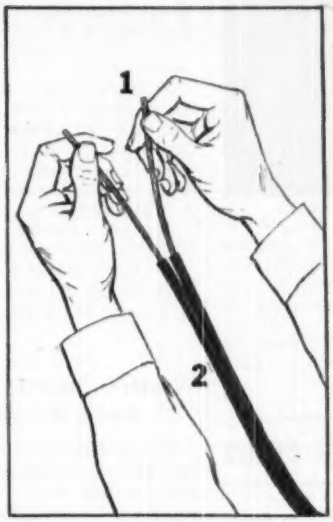
2 Great New "Rough Weather" Cables for Modern Street Lighting

❶ STREET LIGHTING POLE AND FIXTURE CABLE

Here at last is a truly weatherproof cable—and it's made by U. S. Rubber! No festooning, no unravelling or loose ends—thanks to the Neoprene jacket (1) which eliminates fibrous cover. The belt (2) is made of U. S. Rubber's famous Uskorona for extra protection. The insulation (3) is also Uskorona, which is highly resistant to ozone, moisture, heat and cold.

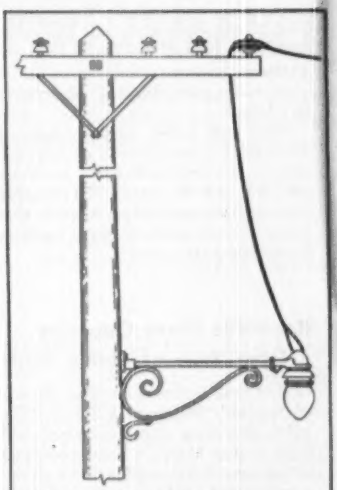


❷ MULTIPLE CIRCUIT "ZIP-CORD" CABLE



Unique construction allows quick separation of conductors by "zipping" the cord.

The Zip-Cord construction (1) makes installations and connections simple and quick on open drops, on series circuits, multiple circuits or secondaries of I.L.'s. Here again this cable will not festoon. The smooth Neoprene cover(2) is specially compounded for rough weather duty. Neoprene makes the wire lighter, smaller in diameter than the ordinary braid construction. The Neoprene cover lasts almost indefinitely even in areas where the weather cycles are extremely severe.



BRACKET TYPE INSTALLATION

For more information write Electrical Wire and Cable Department, United States Rubber Company, Rockefeller Center, New York 20, N. Y.

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U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MANUFACTURERS and MARKETS

New Refrigerator Plant to Be Built by Hotpoint

Hotpoint, Inc, will build a new refrigerator factory on a 21-acre site on 54th Ave at 16th St in Chicago. All production of Hotpoint refrigerators will be concentrated in the new plant, expected to turn out 400,000 units a year.

Construction will begin in the spring. The plant is expected to be finished in about 15 months and in production three months later. It will employ an estimated 3,000 persons.

Other changes will be made this year to complete the company's expansion program launched in 1947. Tooling and machine installations for conversion of Hotpoint's former range plant to manufacture of home laundry equipment will be completed this year. Disposall manufacture will be moved into the Milwaukee plant, where the unit will be made along with automatic dishwashers and sink units as a companion piece. All engineering will be consolidated by moving the engineering department for commercial cooking equipment to the main research laboratories in Chicago.

With these moves all the company's facilities for manufacture of complete electric kitchens and home laundries and its electric commercial cooking lines will be centralized in the Midwest, with all products being made in company-operated plants.

•

Reynolds Plans Capacity Operation of Jones Mills

First capacity operation since the war of Reynolds Metals Co's Jones Mills, Ark., aluminum reduction plant will begin late in March. Then production at the rate of 144 million lb of aluminum annually will be possible.

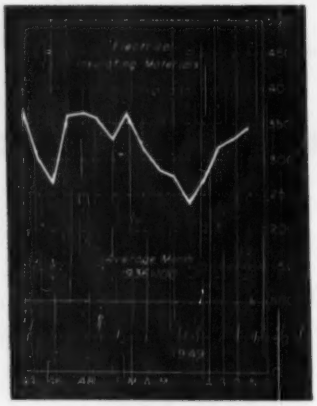
Adequate electric power soon will become available from the new Lake Catherine Plant, now nearing completion under a long-term contract with Arkansas Power & Light Co. Reynolds plans to reopen its third 36-million-lb-capacity pot line in February and the fourth late in March.

Lack of power limited operation to two pot lines when Reynolds leased the plant from the government in 1946. The third line was in operation from last April, when AP&L supplied power, to August, when a strike closed down the plant. When operation was resumed in September, only two lines were started.

•

Insulating Material Sales Show Rise in November

Insulating material sales rose in November by the same percentage as



in the previous month. The index of sales billed on electrical insulating materials, compiled by the National Electrical Manufacturers Association, was 345 in November, 4% above the 330 recorded in October.

November sales were 12% below the same period of 1948, when the index stood at 391.

MANUFACTURING BRIEFS

Product sales offices have been moved to Kaiser Aluminum & Chemical Corp's Newark, Ohio, plant for electrical conductor and cable; wire, rod, and bar; and pig, ingot, and billets.

Sylvania Electric Products Inc has reorganized its California sales division into two separate divisions, a central Pacific one, with headquarters in San Francisco, and a south Pacific, with headquarters in Los Angeles. Robert C. Harper, formerly of the Los Angeles sales office, has been appointed central Pacific sales manager of lighting products, and Charles I. Brady, former supervisor of commercial engineering for lamps, has been named to the same position in the south Pacific division.

New address of Electro Switch Corp is 167 King Ave, Weymouth 88, Mass. The change came about when the town renamed and redefined some of its suburban streets.

•

Reynolds Metals to Mine Bauxite in West Indies

Economic Cooperation Administration has signed a $10,963,000 agreement with Reynolds Metals Co, Richmond, Va., for development of new bauxite mines in the British West Indies. The project is designed to boost the American aluminum stockpile and increase dollar earnings of the British possession.

ECA will advance $5,963,000 as a direct Marshall Plan grant and an additional $5 million from British counterpart funds. The company will repay these advances by aluminum shipments to the government stockpile over a 20-year period.

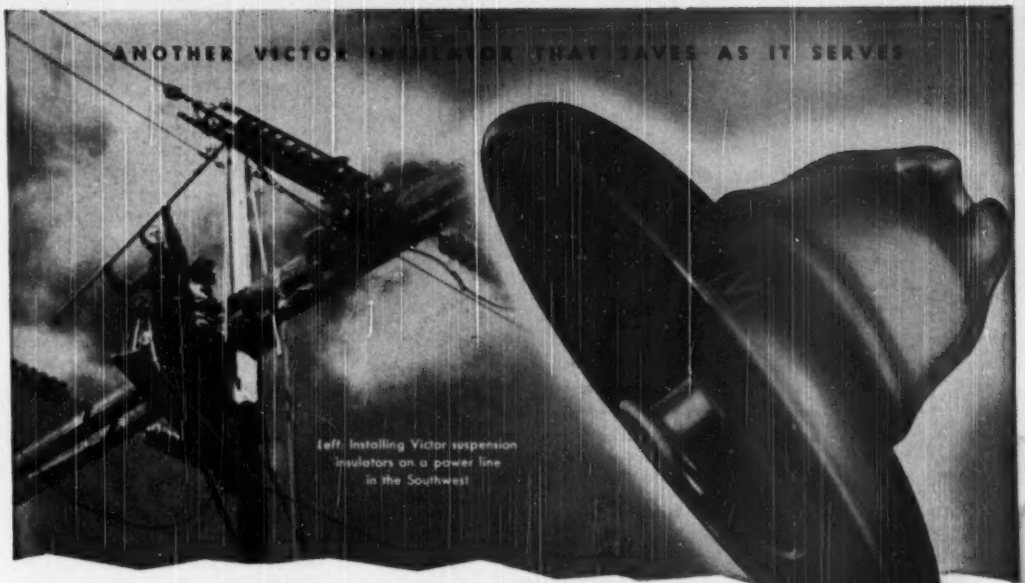
Reynolds Jamaica Mines, Ltd, formed to carry out the project will spend approximately $14.5 million on it, Richard S. Reynolds, Jr, president of Reynolds Metals said.

•

Western Electric Quits Radio Broadcast Field

Western Electric Co is withdrawing from the radio broadcasting equipment manufacturing field. Its place as a supplier to Graybar Electric Co will be taken by a newly formed company, Standard Electronics Corp of Providence, R. I.

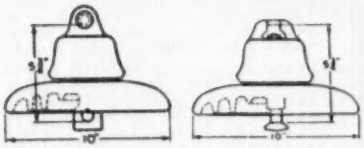
Graybar will distribute the new firm's products but has no financial interest in it. Standard Electronics will make radio broadcasting and television, microwave and radio communications, and other electronic equipment.



Left: Installing Victor suspension insulators on a power line in the Southwest

Install Victor Suspension Insulators

FOR DEPENDABLE ON-THE-JOB PERFORMANCE



No. 800 Clevis type

No. 900 Ball and socket type

VICTOR No.		800 and 900
60 cycle dry flashover	KV	80
60 cycle wet flashover	KV	50
Pos. impulse flashover	KV	125
Neg. impulse flashover	KV	130
Dry arcing distance	In.	7⅝
Leakage distance	In.	11½
Impact rating	In. Lbs.	55
M and E strength	Lbs.	15000

CONTINUOUS, trouble-free insulator service *counts* when it comes to *lower* maintenance and replacement costs on transmission lines. That's why more and more successful power companies are *specifying* Victor suspension insulators.

Even under the most severe service conditions, you can rely on Victor's rugged suspension insulators for years of uninterrupted transmission. *Each* one is rigidly inspected and tested at *every* point of manufacture, and must *easily* meet *all* NEMA standards. For you this means dependable performance *on the job!*

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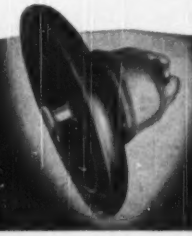

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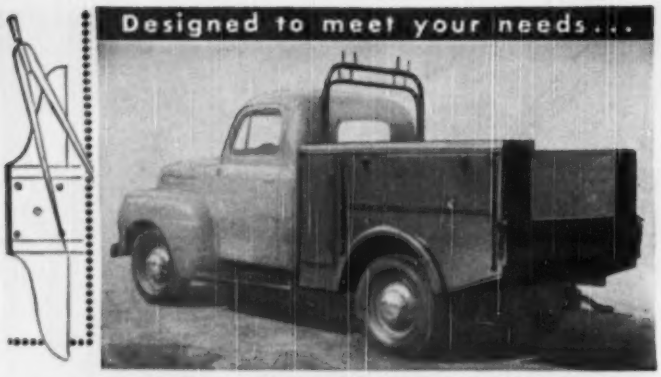

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It will provide maintenance parts and service to users of Western Electric equipment, based on information to be supplied by the latter.

Edwin M. Martin, former chairman of the board of American Bosch Corp, will be president and chairman of Standard, and Robert F. Moyer, president of Standard Machinery Co of Providence, will serve as vice-president and treasurer.

Western Electric is leaving the field to concentrate on existing contracts with Bell System companies and government agencies. Manufacture of AM and FM broadcast transmitters represents only a small percentage of its operations.

•

New Sales Assignments

Electrical manufacturing companies have announced the following appointments to their sales staffs:

Westinghouse Electric Corp's Lamp Division has made several changes. Three new sales divisions have been formed within the Middle Atlantic district. Harry A. Croasdale has been appointed manager of the Penn-Jersey division, including eastern Pennsylvania, south Jersey, Delaware, and the eastern shore of Maryland; Edward S. Barrington of the Chesapeake division, including the remainder of Maryland, northern Virginia, eastern West Virginia, and the District of Columbia, with headquarters in Baltimore; and John C. Downing of the Virginia division, including lower belt Virginia, northeastern North Carolina, southern West Virginia, eastern Kentucky, and eastern Tennessee, with headquarters in Richmond, Va. William A. Massey is manager of the New York State division, newly formed within the Eastern district to include Buffalo, Rochester, Syracuse, Albany, Utica, and Binghamton in upstate New York. His headquarters will be at 700 West Genesee St, Syracuse. Another new division, Greater New York, will include Manhattan, the Bronx, Brooklyn, and Queens and Putnam, Westchester, Nassau, and Suffolk Counties. Edward V. Bergui, with headquarters at 40 Wall St, is manager.

Standard Transformer Co, Warren, O., has appointed A. J. Elggren & Sons Co, 428 South West Temple St, Salt Lake City, Utah, exclusive representative covering Utah, Idaho, and western Wyoming.

Marathon Electric Manufacturing Corp, Wausau, Wis., has opened an office in Seattle, Wash., with H. S. Emanuels as Northwest district manager.

Modern Light & Equipment Co, Chicago has appointed Philip DeVeau, 743 N Fourth St, Milwaukee 3, to cover the upper Michigan peninsula and Wisconsin except for Ashland, Eau Claire, and LaCrosse. C. F. Buschagen, 18613 Strathmoor Ave, Detroit 2, will handle sales in the rest of Michigan.

Slater Electric & Manufacturing Co, Woodside, N. Y., has appointed Clyde W. Lint representative in the Chicago and northern Illinois area and W. H. Berry, Jr, in Georgia, Alabama, and Florida.

FREE

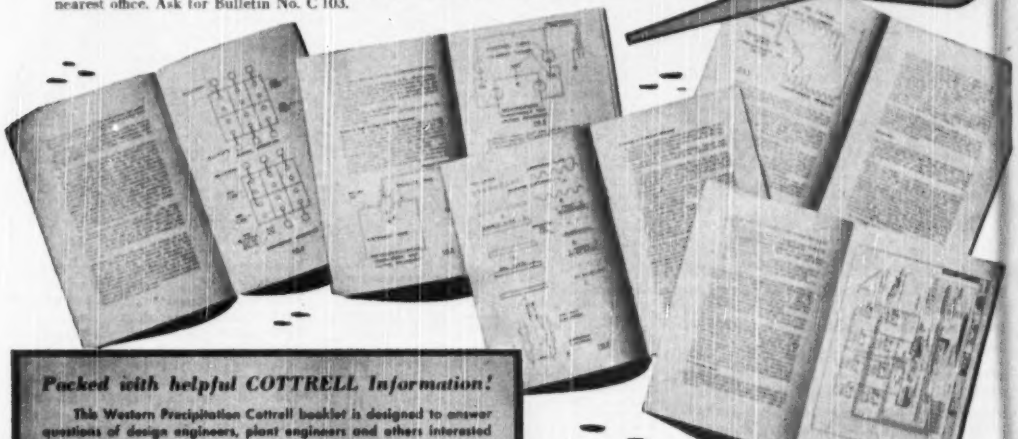
From Western Precipitation—the organization that pioneered the commercial application of Cottrell Precipitation...

IF YOU ARE ENGAGED in any phase of industry where the recovery of dusts, fumes, fly ash, mists, fogs or other suspensions from gases is a problem, you will find this booklet on the COTTRELL Electrical Precipitator helpful and informative.

Western Precipitation pioneered and installed the first commercial application of the well-known COTTRELL Electric Precipitator—Dr. Cottrell, the inventor, being a member of the company. And for more than 42 years Western Precipitation has consistently led in developing new COTTRELL advancements and techniques for recovering suspensions from gases, both wet and dry.

This 28 page booklet summarizes many of the basic facts you should know about modern COTTRELL Precipitators—the various types available, how they operate, principal types of electrode systems and rectifiers, shell constructions, etc. As long as the supply lasts, a free copy will be sent you on request to our nearest office. Ask for Bulletin No. C 103.

28 PAGES
of helpful facts to know about
COTTRELL ELECTRICAL PRECIPITATORS



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- **Mechanical and Electronic Rectifiers.**
- **Various types of Collecting Electrodes (rod curtains, corrugated plates, dual plates, pocket electrodes, etc.).**
- **Removal of Collected Material.**
- **Factors in Shell Construction (steel, concrete, brick, etc.).**
- **Operating Efficiencies and the Effect of Various Factors on Performance.**

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Western Precipitation is not affiliated with any other company in the field of electrical precipitation except its wholly owned subsidiaries, International Precipitation Corporation and the Precipitation Company of Canada, Ltd. Whether you are now contemplating the installation of a Cottrell Electrical Precipitator, or may be interested in such an installation at a future date, we can and will serve you in any part of the United States or other countries.

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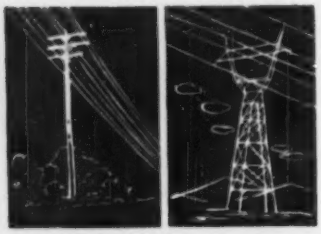

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NEW ELECTRICAL CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Ala., Chickasaw—Alabama Power Co., 600 N. 18 St., Birmingham, steam electric plant addn. Approx. $100,000.

Arkansas—U. S. Eng., 200 Broadway, Little Rock, powerhouse and switchyard, Bull Shoals Dam Power Development, CIVENG-03-050-50-41.

Arkansas—Ouachita Rural Electric Cooperative, Camden, 60 mi. single phase line, 11 mi. three phase line, 5 mi. 33 kv transmission line, 37 mi. conversion, etc., Ouachita Co. Popper & Mathews, Yazoo City, Miss., engrs.

California—Bureau Reclamation, Dpt. Interior, Sacramento, materials for control and power cable trays and brackets for Tracy switchyard, Bethany, Central Valley Proj., Spec. R 2-87 Region 3. L. N. McClellan, Bldg. 1-A, Denver Federal Center, Denver, Colo., ch. engr.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars shipping point or f.o.b. cars Brush, Colo., power transformer, lighting arresters, tap changer, circuit breakers, lifting devise, selector switches, grounding blades, disconnecting switches, horn-gap switch, disconnecting fuses for Beaver Creek substation, Colorado-Big Thompson Proj., Spec. 2918. L. N. McClellan, ch. engr.

Colorado—Bureau Reclamation Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo. constr. Green Mountain (Kremmling Tap)—Oak Creek 115- kilovolt transmission line, in Grand and Routt Counties, Spec. 2916. L. N. McClellan, ch. engr.

Idaho—Northern Idaho Rural Electric Rehabilitation Assoc., Sandpoint, 111 mi. rural distr. lines and system imprvs., Bonner Co. $400,000.

Illinois—Southeastern Illinois Electric Co-operative, A. F. Lentz, mgr., Harrisburg, addnl. rural distr. lines, other system imprvs., Saline Co. $415,000.

Kentucky—Jackson Co. Rural Electric Co-operative Corp., McKee, 350 mi. rural distr. lines, sys. imprvs., Jackson Co. $915,000.

Mass., Tewksbury—Commonwealth of Mass., Dpt. P. Welfare, 600 Washington St., Boston, plant changes incl. installing turbo-generator, $100,000.

Minn., Minneapolis—Northern Pacific Railway Co., 176 E. 5 St., St. Paul, 1 story, 45x50 ft., concrete, steel, power plant with 27x30 ft. wing, Approx. $68,000. L. B. Curtiss, Northern Pacific Bldg., 176 E. 5 St., St. Paul, archt.

Mississippi—Northeast Mississippi Electric Power Assoc., Oxford, 189.5 mi. rural distr. lines, sys. imprvs., Lafayette Co. $510,000.

Missouri—North West Electric Power Co-operative, Savannah, 257 mi. 157 kv, and 505 mi. 69 kv. rural distr. lines, 40,000 kv. steam generating plant, near Missouri City. $18,393,000.

Missouri—Black River Electric Co-operative, Ironton, 536 mi. rural distr. lines, sys. imprvs., Reynolds Co. $1,120,000.

Montana—Southeast Electric Co-operative, Ekallaka, 136.5 mi. rural distr. lines, $150,000; 0.4 mi. 57 kv line, 36.6 mi. 34.5 kv line, with 26.7 mi. 7.2 kv single phase underbuilt and 3 substations, $75,000, in Fallon and Carter Counties, Associated Engineers, 206-12 St., Bismarck, N. D., engrs.

Nebraska—Bureau Reclamation, Dpt. Interior, Casper, Wyo., one 115,000 volt and two 34,500 volt circuit breakers and three 115,000 volt disconnecting switches for Sidney substation, Spec. R7-108 (Region 7), Missouri River Basin Proj.

North Dakota—The Verendrye Electric Co-operative, Velva, 689 mi. rural distr. lines, completion previously approved construction and 69 mi. transmission lines. $1,418,000. Banister Eng. Co., 1514 University Ave., St. Paul, Minn., consult. engr.

N. D., Grand Forks—Minnkota Power Co-operative, Grand Forks, superstructure for steam plant extens. Ellerbe & Co., First Natl. Bank Bldg., St. Paul, Minn., engrs.

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MORE INSTALLATIONS IN 1950

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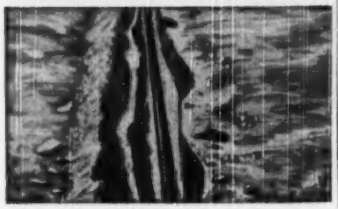

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Why Orangeburg Is The Leader

Orangeburg's experience in the fibre conduit field goes back 57 years. Since 1893, leading public utilities have used Orangeburg Conduit to protect cables underground. Today, Orangeburg is a predominating choice of utilities and municipalities—and of practically all design engineers.

Further investigation shows that Orangeburg has innovated *all* the important advancements of the fibre conduit industry. It is known as a company that stands back of its product—another reason why many consider it the fibre conduit to use—why Orangeburg is the established leader—the conduit to install for *lifetime* cable protection.

NO ELECTROLYSIS

Vital cables need permanent protection from stray currents, electrolytic action and chemical corrosion. Orangeburg Conduit—with its non-conducting properties, impermeable walls and tight joints—gives cables this protection.

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For main electrical distribution where duct banks of four or more ducts are required, Orangeburg *Standard* (Type 1) is the *preferred* conduit all over America. It is installed *with* concrete encasement—the method of installation employed by big users when putting transmission lines under ground to stay.

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A trip through the Orangeburg plant shows quality standing out everywhere. You see there conduit being built for *permanence* in America's most modern and completely equipped factory—by craftsmen of exceptional skill and experience. You see why conduit, made Orangeburg's way, can give lifelong protection to cables underground—because it is non-corrosive and water-tight—because of its resistance to corrosive ground waters, its low breakage and minimum pulling friction.

First Cost is the Last Cost

In the experience of utilities, municipalities, railroads and other big users, initial and installed costs run lower when Orangeburg Conduit is used. For one reason, it permits longer runs. A second reason is its light weight and ease of installation. A third, the elimination of maintenance and repair costs. After half a century, many Orangeburg installations are still in active use, and when inspected prove to be as good as new.

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Orangeburg's unique materials have the toughness and resiliency to bear up under traffic shocks, sudden soil settlements or heavy loads without damage.

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More push behind the product. Extensive, year-round advertising and promotion are telling the world the whole story about the advantages of Orangeburg...the *lifetime* conduit...the *leader* and *first* choice in every city and state in the Union.

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O., Oxford—Dpt. P. Wks., W. O. Linzell, dir., State Office Bldg., transmission lines, electric and steam, excavation, piping, underground conduit, fittings, valves, appurtenances on Campus Miami University. **$100,000.** Fosdick & Himler, Union Trust Bldg., 4 and Walnut Sts., Cincinnati, engrs.

Oklahoma—Western Electric Co-operative, Hollis, 877 mi. 69 kv. rural distr. lines and 13 new distribution sub-stations, Caddo and Comanche Counties, 30,000 kw. steam generating paint near Anadarko, **$12,353,000.**

Oregon—Blachly-Lane County Electric Co-operative Assn., Blachly, 45 mi. rural distr. lines, Lane Co. Plans deposit $10. Wismer & Becker, 1219 28 St., Sacramento, Calif., engrs.

Pa., Millersville—General State Auth., 18 and Herr Sts., Harrisburg, electrical distr. sys. at Millersville State Teachers College. **$187,000.** Glatfer & Diehl, 321 N. Front St., Harrisburg, consult. engrs. A. F. Jones, c/o owner, ch. engr.

South Dakota — East River Electric Power Co-operative, Sioux Falls, rural distr. lines sys. and generating plant. **$11,500,000.**

Tex., Lubbock—City, electric light and power plant expans. $275,000. G. K. Harris, city engr.

Wyoming and Nebraska—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing, del. f.o.b. cars at shipping point or f.o.b. cars at Cheyenne and Casper, Wyo., Gering, Neb., Greeley, Loveland and Brush, Colo., substation equipment at Beaver Creek and Greeley substations and Estes and Flatiron Power Plants, Seminoe Power Plant, Kendrick Proj. Wyo., Alcova and Gering substations, Kortes Power Plant, Missouri River Basin Proj. Spec. 2929. L. N. McClellan, ch. engr.

Low Bidders & Contracts Awarded

Ia., Denison—City, Bd. Trustees, Municipal Electric Light and Power Plant, Jan. 30, piping for municipal electric light and power plant imprvs., from Winger Constr. Co., 1200 E. Main St., Ottumwa. **$88,000.**

La., Monroe—City, municipal power plant exten., to Thomas Bryan & Assoc., Inc., 620 M. & M. Bldg., Houston 2, Tex., **$559,000.** Bids 1/25.

N. D., Velva—Central Electric Power Co-operative, Velva, turbines for steam generating plant, to General Electric Co., 840 S. Canal St., Chicago, Ill., **$1,000,000** sub-station transformers, to Westinghouse Electric Co., 40 N. Wacker Dr., Chicago, Ill. **$129,000.** Bids 12/28.

Tex., Bryan—City (2nd unit) municipal power plant. Owner builds. **$625,000.** Bids

Tex., Corpus Christi—Central Power & Light Co., 120 N. Chaparral St., power line extension, force account. **$350,000** (Unit 2).

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Ill., Chicago—Veterans Admin., Vermont Ave. between H and I Sts., N. W., Wash., 25, D. C., research hospital for Veterans Administration at Erie, Huron Fairbanks Ct. and McClurg Sts., $6,000,000.

Low Bidders & Contracts Awarded

Conn., Meriden—City of Meriden Housing Auth., 37 Gale Terrace, brick veneer, frame housing, Yale Acres, A. Dapont Constr. Co., 1801 Thomaston Ave., Waterbury. **$1,520,000.**

Minn., Minneapolis—Director, Technical Services, Veterans Admin., Vermont Ave. between H and I Sts., N. W., Wash. 25, D. C., general contract 8 story Veterans Hospital addn., 54 St. and 48 Ave., to J. D. Hedlin Construc. Co., 820 Michigan Ave. N. E., Wash., D. C., **$5,493,000** steel water tank and tower to Pittsburgh-Des Moines Steel Co., Neville Island, Pittsburgh, Pa. **$54,600** boiler house and addn., boiler and equipment replacement, Fuel Economy Engrg. Co., 510 New York Bldg., St. Paul, **$238,300.** Grand total **$5,785,900.**

Pa., Phila.—Country Club Estate, Inc., c/o Mayer I. Blum & Son, 2601 Parkway, apartment, shopping center and theatre, City Line and Monument Ave., to Turner Constr. Co., 1500 Walnut St., Approx. **$18,000,000.** Sweet & Schwart, 5450 Wissahickon Ave., archts.

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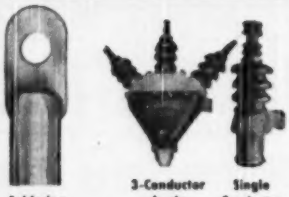

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LETTERS TO THE EDITOR

Treat All Business Equally

To the Editor of ELECTRICAL WORLD:

The electric public utility industry is making a nation-wide effort to inform the people of the spreading establishment of socialism and public ownership in this country, with the absorption of the electric industry as the first step in the program. After listening recently to an exceedingly well prepared and delivered statement of the subject, the writer was convinced that simply to go around telling our story, as fearful as it is, and to expect it to arouse enough people to the right kind of action, is ineffective. We need a different and more positive attack. . . . the average person who hears our appeal about the danger of public ownership probably wonders what we are crying about and why we cannot settle our own problems. Many of them may say simply "so what?"

. . . Without disparagement of the power of the press and of our current advertising campaign, which should be continued for what it can do, we should be more vocal. We should employ good speakers all over the land. They should not necessarily be from within our industry. They should be chosen for their ability to convince and to use the language of their listeners. It takes spell-binders to offset spell-binders and we must not overlook that much of the present acceptance of socialistic ideas was spread by just such propaganda. These men should be well informed and should be supported at all times by a central fact-finding committee. They should talk to all sorts of groups —luncheon clubs, parent teachers associations, labor and farm groups in particular, education groups and students. Their theme song should be equal treatment of all business, whether publicly or privately owned.

W. E. Rogers

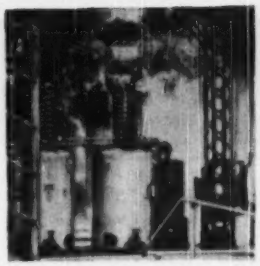
1217 Pickwick Place
Indianapolis, Indiana

Hardware Packaging Lauded

To the Editor of ELECTRICAL WORLD:

My compliments on the article in the January 2nd issue covering George Balch's Standard Packaging Committee work. The facts are well and accurately presented and the illustrations help to make the story interesting.

R. P. Snow
Chairman
EEI Purchasing and Stores Committee
Cleveland, Ohio

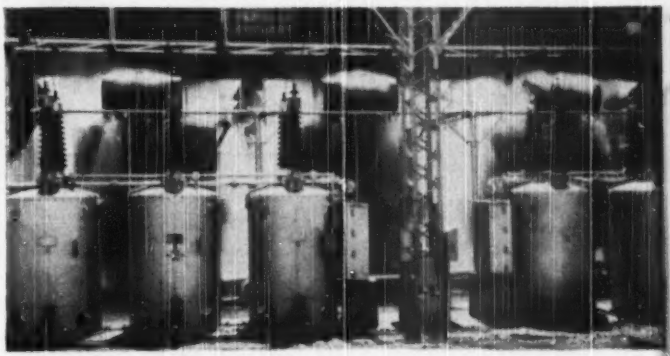


WITHOUT SPECIAL PROTECTION

This transformer fire did $50,000 damage at an electric power station.

MULSIFYRE NOW ON GUARD TO KILL OIL FIRES *FAST*

Transformers at this electric power station are now safeguarded by a Grinnell Mulsifyre installation. Fast, automatic spray action is being demonstrated here.



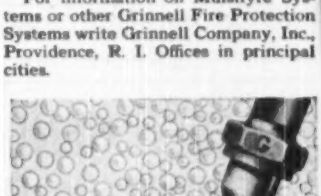
WHEN AN OIL FIRE breaks out in transformers protected by a Mulsifyre system, a battery of spray projectors puts out the fire . . . fast. Automatic, heat-actuated release devices assure quick operation. Extinguishment occurs within a few seconds after the emulsion-forming spray strikes the surface of the burning oil.

Mulsifyre projectors are approved by Underwriters' Laboratories, Inc. for extinguishing fires in flammable oils immiscible with water, wherever such oil is a fire hazard. There is no conductivity along the discharge of a Mulsifyre projector when the spray strikes conductors carrying high voltages.

Mulsifyre high-velocity projectors produce drops large enough and drive them fast enough to penetrate the flames without complete vaporization in flight, but limit their velocity so the surface of the burning liquid is agitated into an emulsion instead of passing through the oil without fire-extinguishing effect. After a period of time, the emulsion breaks down, oil and water separate, and the oil can be reclaimed.

Mulsifyre systems have proven their effectiveness during sixteen years of extinguishing transformer fires. Today they protect hundreds of installations all over the world.

For information on Mulsifyre Systems or other Grinnell Fire Protection Systems write Grinnell Company, Inc., Providence, R. I. Offices in principal cities.



GRINNELL *Mulsifyre*

EMULSION-EXTINGUISHMENT OF OIL FIRES

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U. S. Government

UNITED STATES DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Specifications No. 2918) will be received by Bureau of Reclamation, Denver, Colorado, March 23, 1950, and then publicly opened for furnishing one 110/63.5-to 13.8-kv, 38,400/48,000-kva, 3-phase, 60-cycle, oil-immersed, power transformer; 9 power circuit breakers with voltages, amp ratings, and interrupting capacities varying between 14.4 and 115 kv, 600 and 2,000, and 250,000 and 1,500,000, respectively; 28 air switches with ratings varying between 15 and 115 kv, 600 and 2,000 amp, single and 3 pole; and three 115-kv, 200-amp, single-pole disconnecting fuses for Beaver Creek substation, Colorado-Big Thompson Project, Colorado. Delivery is desired within 60 to 300 days. For particulars, address Bureau of Reclamation, Building 1-A, Denver Federal Center, Denver, Colorado.

MICHAEL W. STRAUS, Commissioner. (100)

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KVA	Make	Type	Volts	Speed
5140	Wtns.		2400/4160	600
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3000	Wtns.		2400/4600	720

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3 ph. 60 cy.

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1500	G.E.	360	275	2300/4600
1500	G.E.	450	600	2300/4150
1250	G.E.	600	275	4150
1000	Wtns.	900	600	4150

TRANSFORMERS—60 Cycle

Kva	Make	Type	Ph	Voltages
2666	Wtns.	OISC	1	69000x11000
2500	Al. Ch.	OISC	3	13200x2300
2500	Pwsh.	AT	3	13800x2300
1250	G.E.	HVDOJ	1	6600x550
1000	Pitts.	OISC	1	13200x2300
600	Al. Ch.	OISC	1	2300/4160x220/440
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167	G.E.	HS	1	2400x240-480

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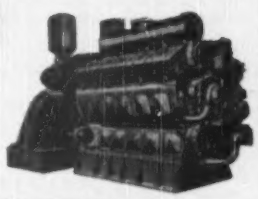

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1250	General Motors	16-278A	1800	720	313	General Motors	3-268A	450	1200
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625	Alco	6-12¼x13T	750	600	187	Ingersoll Rand	8	225	514
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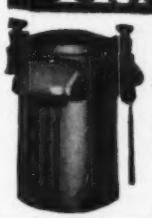

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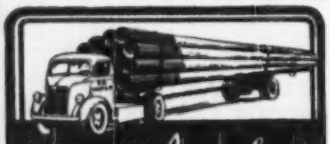

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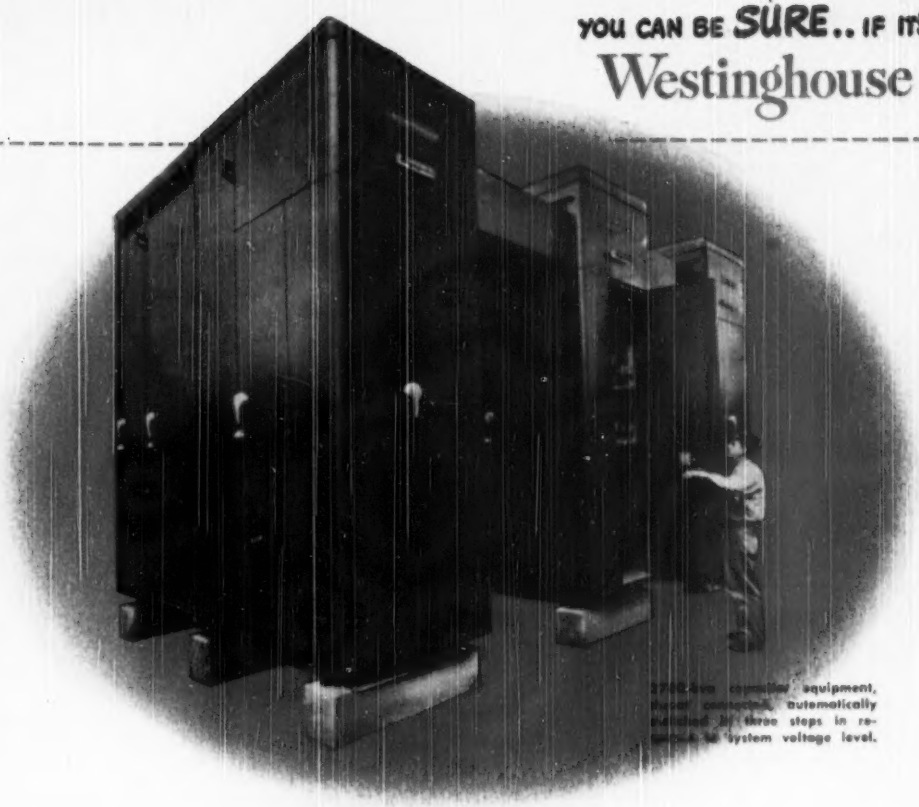
YOU CAN BE **SURE**.. IF IT'S

Westinghouse



2700 kva capacitor equipment, power connected, automatically switched in three steps in response to system voltage level.

WESTINGHOUSE HOUSED CAPACITOR UNITS

Keep Voltage—*AND COSTS*—in line!

You can be *sure* of dependable voltage control with Westinghouse Housed Capacitor equipment. You can be *sure* about savings too, because the Westinghouse unit is designed to trim your substation costs. For example . . .

A compact design allows for smaller substation space . . . lower real estate costs.

Factory assembly assures low installation costs. You need only mount the housing on pads, set capacitor units in place, and make primary connections.

Complete interlocking assures safety to personnel—shorting and grounding the capacitors before housing can be entered.

A self-contained design saves the cost of installing external accessories.

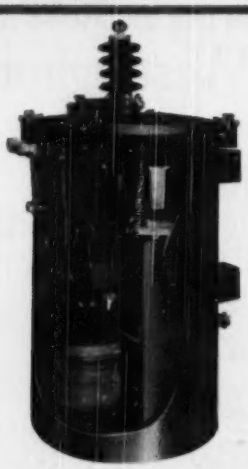
Savings like these are supplemented by extra revenue when good voltage control is maintained at the substation. And Westinghouse housed equipment with built-in automatic control—responsive to line voltage, load current or kva load—assures the finest.

For complete information on Westinghouse Inerteen Capacitors, write for Booklet B-4343. Address: Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-60723

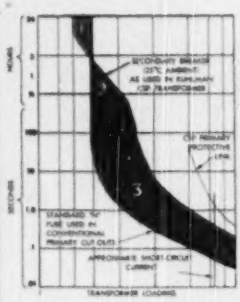
Westinghouse

CAPACITORS

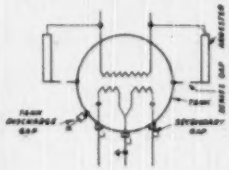
How KUHLMAN CSP transformers give you greater protection



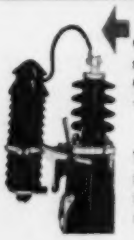
The Kuhlman CSP Transformer is a completely self-protected unit. You need no extra equipment such as primary and secondary fuse devices or external lighting arresters — all are built-in. With this transformer, there is no sacrifice of customer service since the CSP breaker safely permits overloads that would be dropped by the cutout fuse of a conventional transformer.


HOURS
SECONDS
SECONDARY BREAKER (25°C. AMBIENT AS USED IN KUHLMAN CSP TRANSFORMER)
CSP PRIMARY PROTECTIVE LINK
STANDARD 'K' FUSE USED IN CONVENTIONAL PRIMARY CUT OUTS
APPROXIMATE SHORT CIRCUIT CURRENT
TRANSFORMER LOADING

Steady operation regardless of power surges and overloads is routine with the CSP circuit breaker. Despite the name, the breaker *holds* the peaks which are so important in protecting customer service. The diagram shows how the CSP provides better protection by dropping dangerous overloads which might damage installation and by *holding* short-time overloads unnecessarily dropped by conventional transformer cutouts.



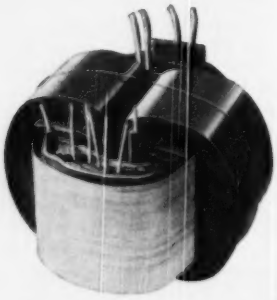
When lightning strikes with its devastating power, it is harmlessly turned aside by the arrester with no service interruption. This arrester is of the expulsion type which by-passes but does not absorb the lightning charge.



Cover mounted arresters are standard equipment on CSP transformers, 7200 volts and up.

Tank wall mounted arresters are standard equipment on CSP transformers through 4800 volts.

The breaker operating handle has "Open", "Close", and "Reset" positions and can be operated from the pole with hot stick. Available with emergency control lever (as shown) for temporarily raising temperature limits.



The famous Kuhlman Bent Iron Core utilizes oriented silicon steel with its superior flux carrying qualities to save steel, copper and oil, and provide a 25% weight saving margin over hot rolled cores.

Lapped joint construction provides 75% reduction in exciting current over butt joint cores.

Cooler operation of the transformer is assured by ample oil ducts in the windings to allow free oil circulation.

Further information on Kuhlman CSP Transformers can be had by writing for this new Bulletin CS-301. Kuhlman also manufactures a complete line of Distribution, Power, and Specialty Transformers. Bulletins on request.

EXPERIENCE COUNTS — THIS IS OUR 56TH YEAR

Kuhlman

KUHLMAN ELECTRIC COMPANY
BAY CITY, MICHIGAN

EXPORT REPRESENTATIVES: *International Standard Electric Corporation,* **67 Broad Street, New York 4, N.Y. Cable Address, Microphone, N.Y.**